ICOM

SERVICE MANUAL

VHF MARINE TRANSCEIVER

IC-M302

Icom Inc.

INTRODUCTION

This service manual describes the latest service information for the **IC-M302** VHF MARINE TRANSCEIVER at the time of publication.

MODEL	VERSION	COLOR
IC-M302	U.S.A	BLACK
	U.S.A–1	WHITE
	U.S.A–2	GRAY

To upgrade quality, all electrical or mechanical parts and internal circuits are subject to change without notice or obligation.

DANGER

NEVER connect the transceiver to an AC outlet or to a DC power supply that uses more than 16 V. Such a connection could cause a fire or electric hazard.

DO NOT expose the transceiver to rain, snow or any liquids.

DO NOT reverse the polarities of the power supply when connecting the transceiver.

DO NOT apply an RF signal of more than 20 dBm (100mW) to the antenna connector. This could damage the transceiver's front end.



ORDERING PARTS

Be sure to include the following four points when ordering replacement parts:

1. 10-digit order numbers
2. Component part number and name
3. Equipment model name and unit name
4. Quantity required

<**SAMPLE ORDER**>

2510001240	Speaker	045P0803	IC-M302	Front unit	5 pieces
8810004540	Screw	BiH M3x8 SUS	IC-M302	Chassis	10 pieces

Addresses are provided on the inside back cover for your convenience.

REPAIR NOTES

1. Make sure a problem is internal before disassembling the transceiver.
2. **DO NOT** open the transceiver until the transceiver is disconnected from its power source.
3. **DO NOT** force any of the variable components. Turn them slowly and smoothly.
4. **DO NOT** short any circuits or electronic parts. An insulated turning tool **MUST** be used for all adjustments.
5. **DO NOT** keep power ON for a long time when the transceiver is defective.
6. **DO NOT** transmit power into a signal generator or a sweep generator.
7. **ALWAYS** connect a 30 dB to 40 dB attenuator between the transceiver and a deviation meter or spectrum analyzer when using such test equipment.
8. **READ** the instructions of test equipment thoroughly before connecting equipment to the transceiver.

TABLE OF CONTENTS

SECTION 1 SPECIFICATIONS

■ GENERAL

• Frequency coverage	: 156.025–157.425 MHz (Tx) 156.050–163.275 MHz (Rx)
• Mode	: 16K0G3E (FM) 16K0G2B (DSC)
• Usable channels	: All USA, international and Canadian channels plus 10 weather channels
• Power supply requirement	: 13.8 V DC ±10 % (negative ground)
• Usable temperature range	: –20˚C to +60˚C; –4˚F to +140˚F
• Current drain (at 13.8 V DC)	: Transmit at 25 W 5.5 A (Max.) Receive max. audio 1.5 A (Max.)
• Antenna impedance	: 50 Ω (nominal)
• Input impedance (MIC)	: 2 kΩ
• Output impedance (Audio)	: 4 Ω
• Dimensions (projections not included)	: 153(W) × 67(H) × 132(D) mm; 6(W)×2⁵⁄₈(H)×5³⁄₁₆(D) in
• Weight	: Approx. 825 g; 1 lb 13 oz

■ TRANSMITTER

• Output power (at 13.8 V DC)	: High 25 W Low 1 W
• Modulation	: Variable reactance frequency modulation
• Maximum frequency deviation	: ±5.0 kHz
• Frequency tolerance	: ±10 ppm
• Spurious emissions	: –70 dBc (High power) –56 dBc (Low power)
• Adjacent channel power	: 70 dB
• Residual modulation	: 40 dB
• Audio harmonic distortion	: Less than 10% at 60% deviation
• Audio frequency response	: +1 dB to –3 dB of 6 dB octave from 300 Hz to 2500 Hz

■ RECEIVER

• Receive system	: Double conversion superheterodyne system
• Intermediate frequencies	: 1st 21.7 MHz 2nd 450 kHz
• Sensitivity	: 0.22 µV at 12 dB SINAD
• Squelch sensitivity	: Less than 0.22 µV
• Adjacent channel selectivity	: More than 70 dB
• Spurious response	: More than70 dB
• Intermodulation rejection ratio	: More than70 dB
• Hum and noise	: More than40 dB
• Audio output power (at 13.8 V DC)	: 4.5 W typical at 10% distortion with an 4 Ω load
• Audio frequency response	: +1 dB to –3 dB of –6 dB octave from 300 Hz to 3000 Hz

Specifications are measured in accordance with TIA/EIA-603

All stated specifications are subject to change without notice or obligation.

■ VHF MARINE CHANNEL LIST

Channel No.			Frequency (MHz)		Channel No.			Frequency (MHz)		Channel No.			Frequency (MHz)	
USA	INT	CAN	Transmit	Receive	USA	INT	CAN	Transmit	Receive	USA	INT	CAN	Transmit	Receive
	01	01	156.050	160.650	21A		21A	157.050	157.050	70*[3]	70*[3]	70*[3]	156.525	156.525
01A			156.050	156.050			21b	Rx only	161.650	71	71	71	156.575	156.575
	02	02	156.100	160.700		22		157.100	161.700	72	72	72	156.625	156.625
	03	03	156.150	160.750	22A		22A	157.100	157.100	73	73	73	156.675	156.675
03A			156.150	156.150		23	23	157.150	161.750	74	74	74	156.725	156.725
	04		156.200	160.800	23A			157.150	157.150	77*[1]	77	77*[1]	156.875	156.875
		04A	156.200	156.200	24	24	24	157.200	161.800		78		156.925	161.525
	05		156.250	160.850	25	25	25	157.250	161.850	78A		78A	156.925	156.925
05A		05A	156.250	156.250			25b	Rx only	161.850		79		156.975	161.575
06	06	06	156.300	156.300	26	26	26	157.300	161.900	79A		79A	156.975	156.975
	07		156.350	160.950	27	27	27	157.350	161.950		80		157.025	161.625
07A		07A	156.350	156.350	28	28	28	157.400	162.000	80A		80A	157.025	157.025
08	08	08	156.400	156.400			28b	Rx only	162.000		81		157.075	161.675
09	09	09	156.450	156.450		60	60	156.025	160.625	81A		81A	157.075	157.075
10	10	10	156.500	156.500		61		156.075	160.675		82		157.125	161.725
11	11	11	156.550	156.550	61A		61A	156.075	156.075	82A		82A	157.125	157.125
12	12	12	156.600	156.600		62		156.125	160.725		83	83	157.175	161.775
13*[2]	13	13*[1]	156.650	156.650			62A	156.125	156.125	83A		83A	157.175	157.175
14	14	14	156.700	156.700		63		156.175	160.775			83b	Rx only	161.775
15*[2]	15*[1]	15*[1]	156.750	156.750	63A			156.175	156.175	84	84	84	157.225	161.825
16	16	16	156.800	156.800		64	64	156.225	160.825	84A			157.225	157.225
17*[1]	17	17*[1]	156.850	156.850	64A		64A	156.225	160.825	85	85	85	157.275	161.875
	18		156.900	161.500		65		156.275	160.875	85A			157.275	157.275
18A		18A	156.900	156.900	65A	65A	65A	156.275	156.275	86	86	86	157.325	161.925
	19		156.950	161.550		66		156.325	160.925	86A			157.325	157.325
19A		19A	156.950	156.950	66A	66A	66A*[1]	156.325	156.325	87	87	87	157.375	161.975
20	20	20*[1]	157.000	161.600	67*[2]	67	67	156.375	156.375	87A			157.375	157.375
20A			157.000	157.000	68	68	68	156.425	156.425	88	88	88	157.425	162.025
	21	21	157.050	161.650	69	69	69	156.475	156.475	88A			157.425	157.425

*[1] Low power only, *[2] Momentary high power, *[3] Receive only

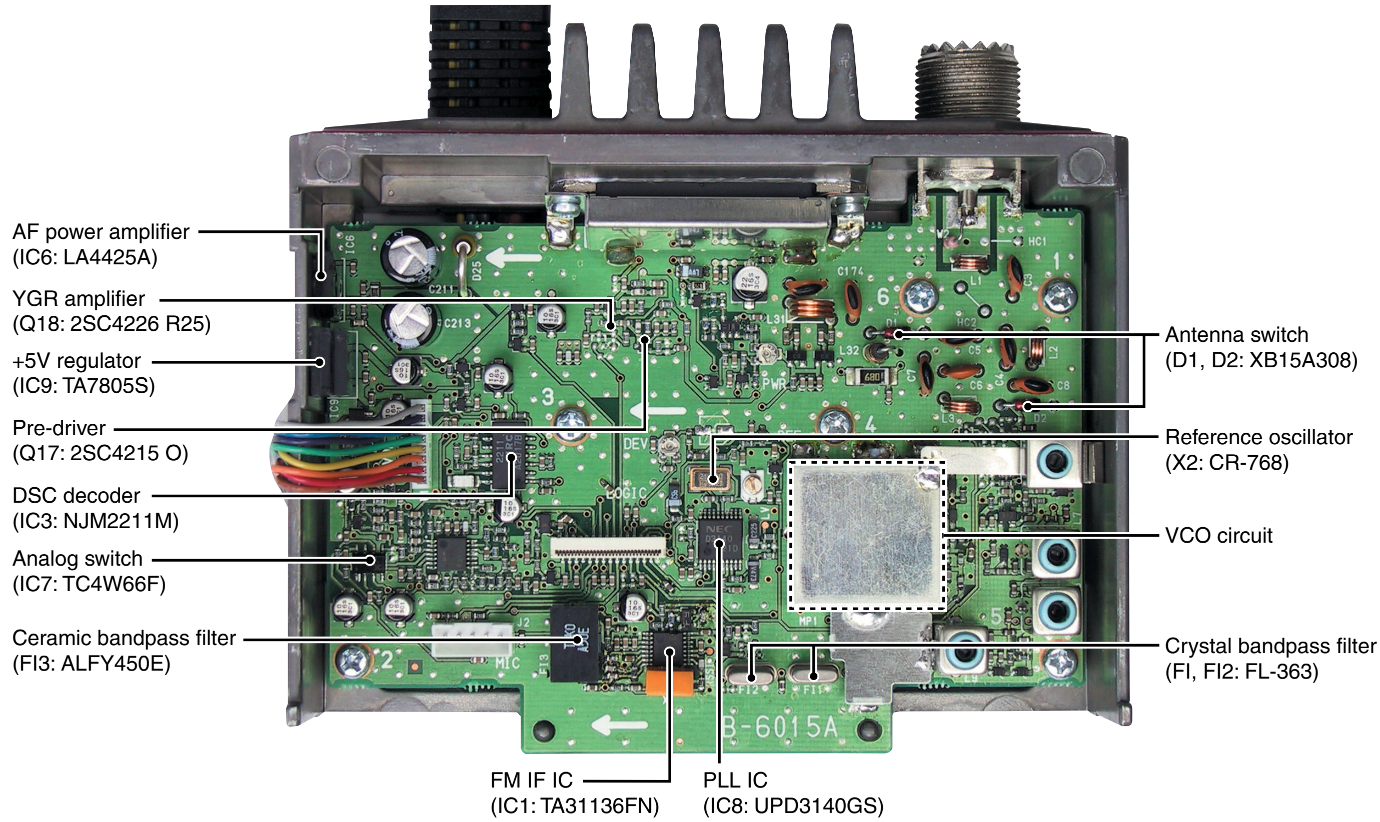
NOTE: Simplex channels 3, 21, 23, 61, 64, 81, 82 and 83 **CANNOT** be lawfully used by the general public in USA waters.

■ WEATHER CHANNEL LIST

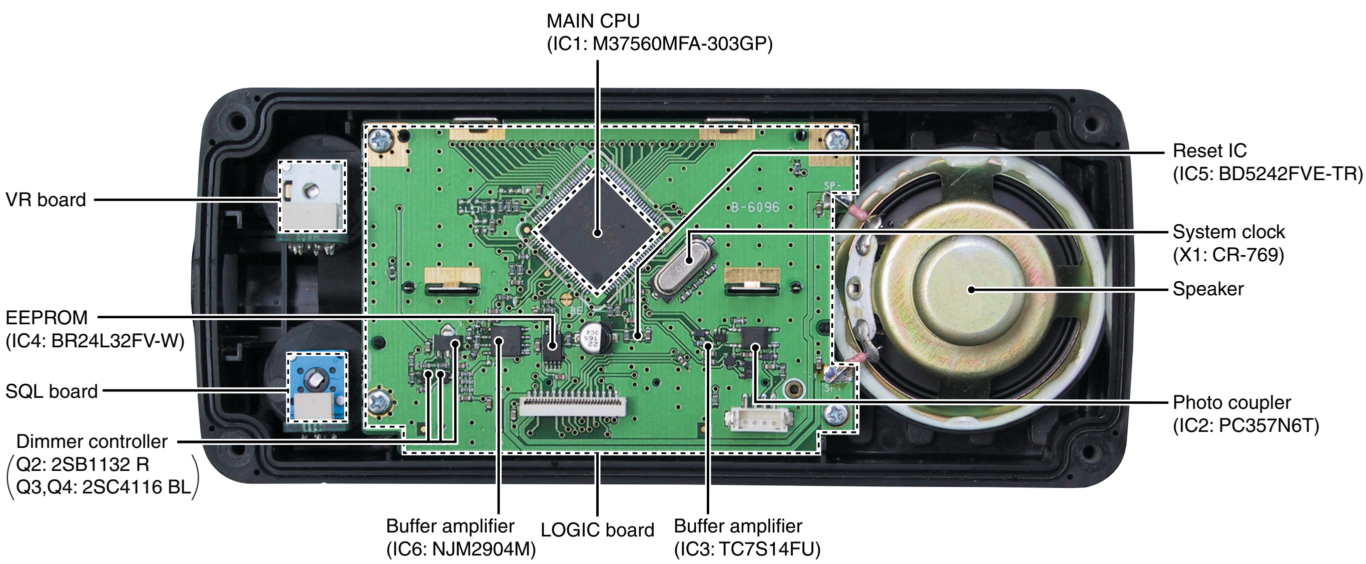
Weather channel	Frequency (MHz)		Weather channel	Frequency (MHz)	
	Transmit	Receive		Transmit	Receive
WX01	Receive only	162.550	WX06	Receive only	162.500
WX02	Receive only	162.400	WX07	Receive only	162.525
WX03	Receive only	162.475	WX08	Receive only	161.650
WX04	Receive only	162.425	WX09	Receive only	161.775
WX05	Receive only	162.450	WX10	Receive only	163.275

SECTION 2 INSIDE VIEWS

• MAIN UNIT



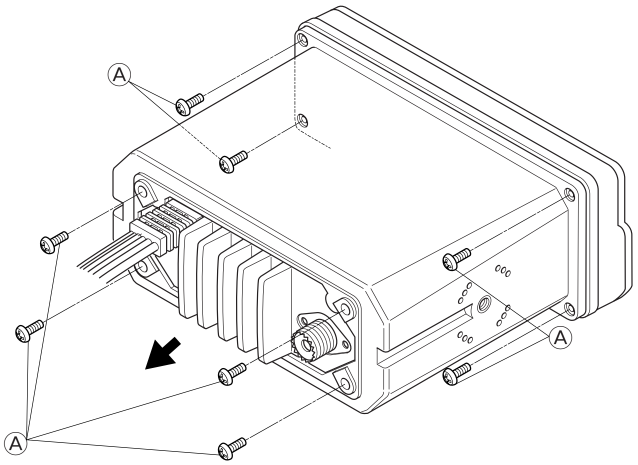
• FRONT UNIT



SECTION 3 DISASSEMBLY INSTRUCTIONS

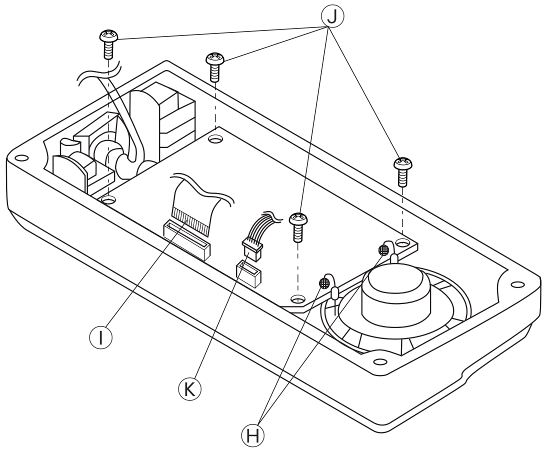
• REMOVING THE CASE

① Unscrew 8 screws, Ⓐ, as shown below, and then remove the case in the direction of the arrow.



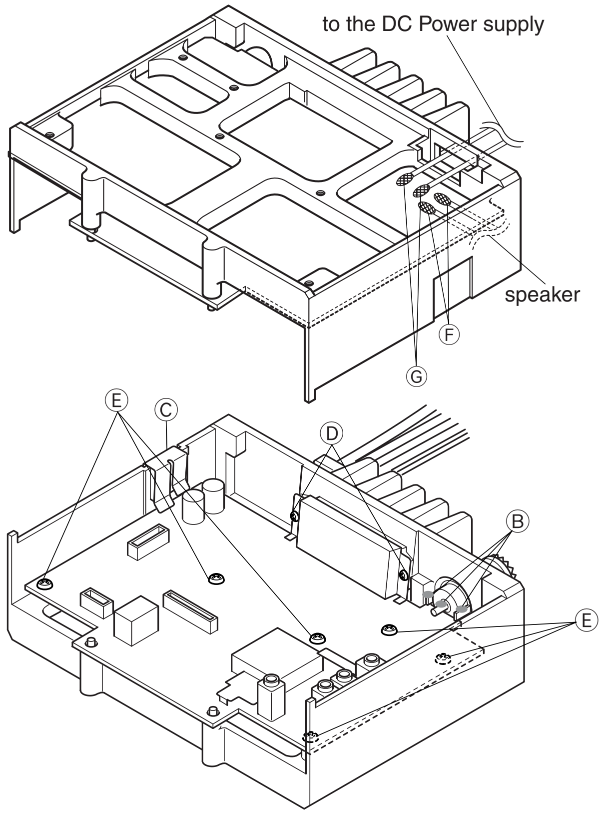
• REMOVING THE LOGIC BOARD

① Remove 2 cables, Ⓘ, Ⓚ.
② Unsolder 2 points, Ⓗ.
③ Unscrew 4 screws, Ⓙ, to remove the LOGIC BOARD.



• REMOVING THE MAIN UNIT

① Unsolder the external speaker cable, Ⓕ (2 points), and DC cable, Ⓖ (2 points), on the bottom side.
② Unsolder the antenna connector, Ⓑ (3 points).
③ Remove a clip, Ⓒ.
④ Unscrew 2 screws, Ⓓ, and 7 screws, Ⓔ, to remove the MAIN unit.



SECTION 4 CIRCUIT DESCRIPTION

4-1 RECEIVER CIRCUITS

4-1-1 ANTENNA SWITCHING CIRCUIT (MAIN UNIT)

The antenna switching circuit functions as a low-pass filter while receiving and as resonator circuit while transmitting. The circuit does not allow transmit signals to enter receiver circuits.

Received signals enter the MAIN unit from the antenna connector and pass through the low-pass filter (L1, L2, C3–C5). The signals are then applied to the RF circuit via the antenna switching circuit (D2).

4-1-2 RF CIRCUIT (MAIN UNIT)

The RF circuit amplifies signals within the range of frequency coverage and filters out-of-band signals.

The signals from the antenna switching circuit pass through the *attenuator (R2, C9) and a tunable bandpass filter (D4, L6, C12–C15) where the object signals are led to the RF amplifier circuit (Q1).
(*Passing through the attenuator is [#10] ONLY.)

The amplified signals at Q1 are applied to other tunable bandpass filter (D5–D7, L8, L9, C23–C26, C28–C32) to suppress unwanted signals and improve the selectivity. The signals are then applied to the 1st mixer circuit.

4-1-3 1ST MIXER AND 1ST IF CIRCUITS (MAIN UNIT)

The 1st mixer circuit converts the received signal to a fixed frequency of the 1st IF signal with a 1st LO (VCO output) frequency. By changing the 1st LO frequency, only the desired frequency will be passed through two crystal filters at the next stage of the mixer.

The signals from the RF circuit are mixed with the VCO signals at the 1st mixer circuit (Q2) to produce a 21.7 MHz 1st IF signal.

The 1st IF signal is applied to two crystal filters (FI1, FI2) to suppress out-of-band signals and is then amplified at the IF amplifier (Q4). The amplified signal is applied to the 2nd mixer circuit (IC1).

4-1-4 2ND IF AND DEMODULATOR CIRCUITS (MAIN UNIT)

The 2nd mixer circuit converts the 1st IF signal to a 2nd IF signal. A double superheterodyne system (which converts receive signals twice) improves the image rejection ratio and obtains stable receiver gain.

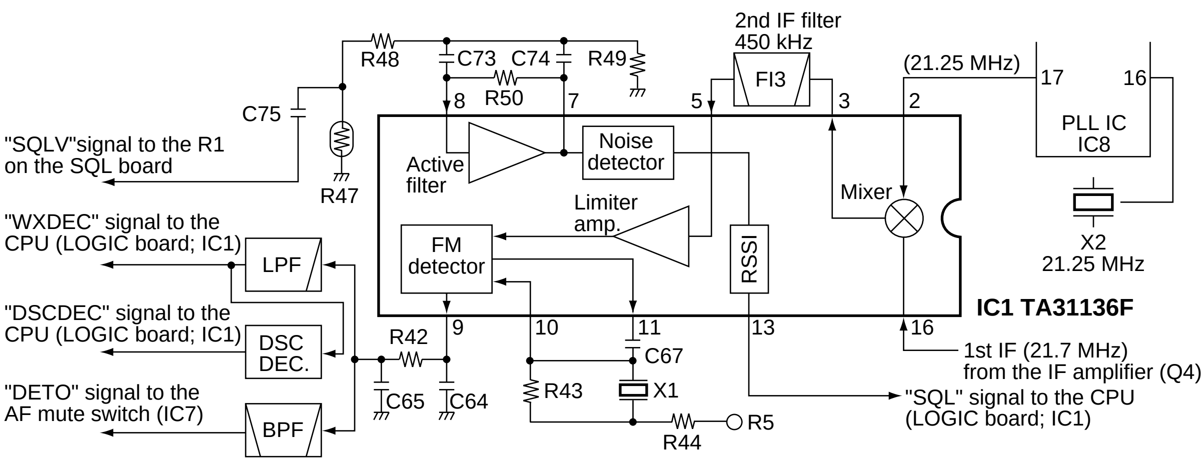
The FM IF IC (IC1) contains the 2nd local oscillator, 2nd mixer, limiter amplifier, quadrature detector, and noise detector circuits, etc.

The 1st IF signal from Q4 is applied to the 2nd mixer section of IC1 (pin 16), and is mixed with a 21.25 MHz 2nd LO signal generated at the PLL circuit using the reference frequency (21.25 MHz) to produce a 450 kHz 2nd IF signal.

The 2nd IF signal from IC1 (pin 3) is passed through the ceramic filter (FI3), where unwanted signals are suppressed, and is then applied to the 2nd IF (limiter) amplifier in IC1 (pin 5). The signal is applied to the FM detector section in IC1 for demodulation into AF signals.

The FM detector circuit employs a quadrature detection method (linear phase detection), which uses a ceramic discriminator (X1) for phase delay to obtain a non-adjusting circuit. The detected signal from IC1 (pin 9) is applied to the AF circuit.

• 2ND IF AND DEMODULATOR CIRCUITS



4-1-5 AF AMPLIFIER CIRCUIT (MAIN AND FRONT UNITS)

The AF amplifier circuit amplifies the detected signals to drive a speaker. The AF circuit includes an AF mute circuit for the squelch.

AF signals from IC1 (pin 9) are applied to the de-emphasis circuit (R61, C89). The de-emphasis circuit is an integrated circuit with frequency characteristic of –6 dB/octave.

The integrated signals pass through the high-pass filter (Q5, R62–R67, C90, C91) to suppress unwanted lower noise signals.

The filtered signals are applied to the AF mute circuit (IC7B), and then passes through the [VOLUME] control (VR board; R1) via the "VOL1" signal. The signals are applied to the AF power amplifier (IC6, pin 1). The output signal from IC6 (pin4) drives the internal (external) speaker.

4-1-6 SQUELCH CIRCUIT (MAIN UNIT, LOGIC AND SQL BOARDS)

A squelch circuit cuts out AF signals when no RF signals are received. By detecting noise components in the AF signals, the squelch circuit switches the AF mute switch.

A portion of the AF signals from the FM IF IC (IC1, pin 9) pass through the squelch adjustment volume (SQL board; R1), and are then applied to the active filter section (IC1, pin 8). The active filter section amplifies and filters noise components. The filtered signals are applied to the noise detector section and output from pin 14 as the "SQL" signal. The "SQL" signal is applied to the CPU (LOGIC board; IC1, pin 30). The CPU analyzes the noise condition and outputs the "RMUTE" signal to toggle the AF mute switches (IC7B).

4-1-7 WEATHER ALERT DECODER CIRCUIT (MAIN UNIT AND LOGIC BOARD)

When the weather alert function is activated and a 1050 Hz alert tone from an NOAA weather radio broadcast is received, the IC-M302 emits beep tones and indicates flashing "ALT" on the display to inform of an emergency weather report on the air.

AF signals from the FM IF IC (IC1, pin 9) pass through the low-pass filter (IC2A) via the "DET" signal, and are then applied to A/D port of the CPU (LOGIC board; IC1, pin 8) as "WXDEC" signal. The CPU has the tone decoder function. When a 1050 Hz signal is detected by software decode, the CPU (LOGIC BOARD; IC1) controls beep tones and the "ALT" indicator.

4-2 TRANSMITTER CIRCUITS

4-2-1 MICROPHONE AMPLIFIER CIRCUIT (MAIN UNIT)

The microphone amplifier circuit amplifies audio signals with +6 dB/octave pre-emphasis from the microphone to a level needed at the modulation circuit.

The AF signals from the microphone are amplified at the microphone amplifier (IC2B) via the analog switch (IC7A, pins 1, 2). A capacitor (C223) and resistor (R167) are connected to the amplifier to obtain the pre-emphasis characteristics.

The amplified signals are applied to the IDC amplifier (IC2C, pin 9) and are passed through the splatter filter (IC2D, pins 12, 14) to suppress unwanted 3 kHz or higher signals. The filtered signals are then applied to the modulation circuit.

4-2-2 MODULATION CIRCUIT (MAIN UNIT)

The modulation circuit modulates the VCO oscillating signal (RF signal) using the microphone audio signals.

Audio signals from the splatter filter (IC2D) pass through the frequency deviation adjustment pot (R184) and are then applied to the modulation circuit (D11, D12) to change the reactance of D11–D14 and modulate the oscillated signal at the VCO (Q13, Q14).

4-2-3 DRIVE AMPLIFIER CIRCUIT (MAIN UNIT)

The drive amplifier circuit amplifies the VCO oscillating signal to a level needed at the power amplifier.

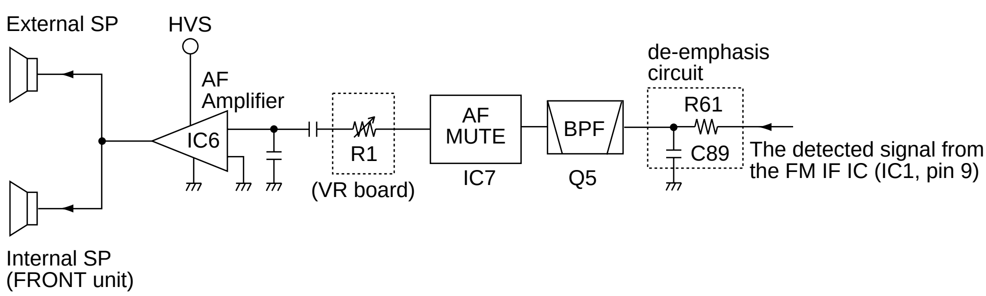
The VCO output is buffer-amplified by Q15 and Q16, and is then applied to the Tx/Rx switch (D16, D17). The transmit signal from the Tx/Rx switch is amplified to the pre-drive (Q17) and YGR (Q18) amplifiers to obtain an approximate 10 mW signal level. The amplified signal is then applied to the RF power amplifier (IC4).

4-2-4 POWER AMPLIFIER CIRCUIT (MAIN UNIT)

The power amplifier circuit amplifies the driver signal to an output power level.

IC4 is a power module which has amplification output capabilities of about 25 W with 10 mW input. The output from IC4 (pin 4) is passed through the antenna switching circuit (D1) and is then applied to the antenna connector via the low-pass filter.

• AF AMPLIFIER CIRCUIT



4-2-5 APC CIRCUIT (MAIN UNIT)

The APC circuit stabilizes transmit output power.

The RF output signal from the power amplifier (IC4) is detected at the power detector circuit (D21, D22, L31) and is then applied to one of the differential amplifier inputs (Q21, pin 3) via the High/Low control circuit (Q22, R135). The applied voltage controls the differential amplifier output (Q21, pin 1) and the bias voltage control (Q23). Thus the APC circuit maintains a constant output power.

4-3 PLL CIRCUITS

4-3-1 GENERAL (MAIN UNIT)

The PLL circuit provides stable oscillation of the transmit frequency and receive 1st LO frequency. The PLL circuit compares the phase of the divided VCO frequency to the reference frequency. The PLL output frequency is controlled by a crystal oscillator and the divided ratio of the programmable divider.

IC8 on the MAIN unit is a dual PLL IC which controls both VCO circuits for Tx and Rx, and contains a prescaler, programmable counter, programmable divider, phase detector, charge pump, etc.

The PLL circuit , using a one chip PLL IC (MAIN unit; IC8), directly generates the transmit frequency and receive 1st IF frequency with VCOs. The PLL sets the divided ratio based on serial data from the CPU on the LOGIC BOARD and compares the phases of VCO signals with the reference oscillator frequency. The PLL IC detects the out-of-step phase and output from pins 8 for Tx and Rx. The reference frequency (21.25 MHz) is oscillated at X2 (MAIN unit).

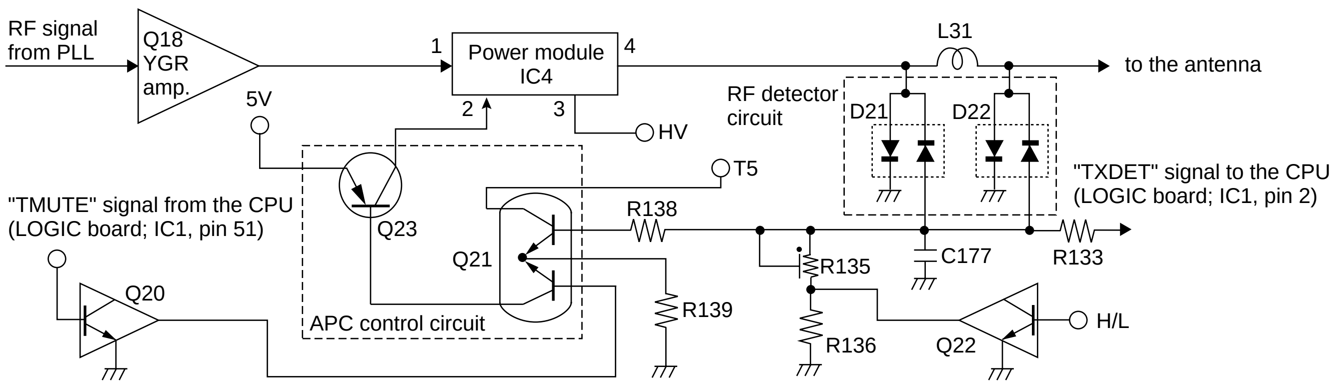
4-3-2 TX AND RX LOOP (MAIN UNIT)

The generated signal at the VCO (Q13, Q14, D11–D14) enters the PLL IC (IC8, pin 2) and is divided at the programmable divider section and is then applied to the phase detector section.

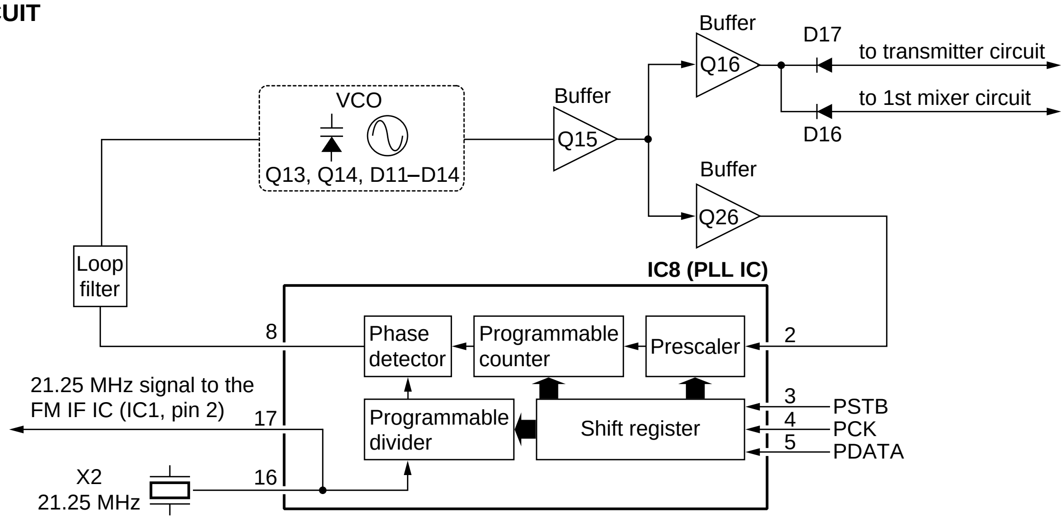
The phase detector compares the input signal with a reference frequency, and then outputs the out-of-phase signal (pulse-type signal) from pin 8.

The pulse-type signal is converted into DC voltage (lock voltage) at the loop filter (R211–R213, C252, C254), and is then applied to varactor diodes (D13, D14) of the VCO to stabilize the oscillated frequency.

• APC CIRCUIT



• PLL CIRCUIT



4-3-4 VCO CIRCUIT (MAIN UNIT)

The VCO outputs from Q13, Q14 are buffer-amplified at the buffer amplifiers (Q15 and Q16), and are then sent to the Tx/Rx switch (D16 and D17). The receive LO signal is applied to the 1st mixer circuit (Q2) through a low-pass filter, and the transmit signal is applied to the pre-drive amplifier (Q17). A portion of the VCO output is reapplied to the PLL IC (IC8, pin 2) via the buffer amplifier (Q26).

4-4 DSC CIRCUITS

4-4-1 DSC ENCODE CIRCUIT (LOGIC BOARD AND MAIN UNIT)

The DSC signal is created at the CPU (IC1, pin 9). The signal passes through the buffer amplifier (IC6A, pins 1, 3), and is then applied to the D/A convertor (R176–R179) to convert into the analog signal. The analog signal passes through the low-pass filter (MAIN unit; IC2D, pins 12, 14), and is then applied to the VCO circuit to modulate the DSC signal.

4-4-2 DSC DECODE CIRCUIT (MAIN UNIT AND LOGIC BOARD)

The AF signal from the FM IF IC (IC1, pin 9) are filtered at the low-pass filter (IC2A, pins 1, 3) to suppress unwanted higher noise signals. The filtered signals are converted analog signals into digital signals at the DSC decoder IC (IC3), and are then applied to the CPU (LOGIC board; IC1, pin 22) via the “DSCDEC” signal.

4-5 LOGIC CIRCUITS (LOGIC BOARD)

• CPU

IC1 is an 8 bit single chip micro-computer and contains LCD driver, serial I/O, timer, A/D converter, programmable I/O, ROM and RAM. The CPU controls to display characters on the LCD too.

• SYSTEM CLOCK CIRCUIT

X1 is a ceramic oscillator and oscillate 7.9872 MHz system clock for the CPU (IC1).

• RESET CIRCUIT

IC5 which is a reset IC outputs a reset signal (“HIGH” pulse signal) to the CPU (IC1, pin 33) from pin 1 when the transceiver turns power ON.

• LOW BATTERY DETECTOR

“HVS” voltage is divided by R14 and R15, and is applied to the low battery detector section in the CPU (IC1, pin 1).

• DIMMER CIRCUIT

CPU (IC1), Q2, Q3 and Q4 compose dimmer circuit. The circuit controls 4 steps LCD backlight (DS2–DS7).

• UART PORT

IC-M302 has the UART port which is used for cloning data and NMEA interface. The signals pass through the photo coupler circuit (IC2), and are then applied to the buffer amplifier (IC3, pin 2). The amplified signals are applied to the CPU (IC1, pin 20).

4-6 POWER SUPPLY CIRCUITS

LINE	DESCRIPTION
HV	The voltage from the connected DC power supply.
HVS	Same voltage as the HV line which is passed through the [PWR] switch (VR-A board; R1).
5V	Common 5 V converted from the HVS line at the 5V regulator circuit (MAIN unit; IC9).
T5	Transmit 5 V controlled by the T5 control circuit (MAIN unit; Q31, Q32) using the SEND signal from CPU (LOGIC board; IC1). The controlled voltage is applied to the transmitter circuit.
R5	Receive 5 V controlled by the R5 control circuit (MAIN unit; Q33, Q34) using the RCV signal from CPU (LOGIC board; IC1). The controlled voltage is applied to the receiver circuit.
R8	Receive 8 V converted from the HVS and R5 lines at the R8 regulator circuit (MAIN unit; Q35, Q36).

4-7 PORT ALLOCATIONS

4-7-1 CPU (LOGIC BOARD; IC1)

Pin number	Port name	Description
2	KEYM	Input port for the HM-141 key signals. **Pushed key** — **Input voltage** [▲] — 2.02 V ±0.12 V [▼] — 3.00 V ±0.13 V [Hi/Lo] — 3.84 V ±0.10 V
3	TXDET	Input port for the transmit detecting signal. High: While transmitting.
4	SQLV	Input port for the squelch volume signal.
6	PCK	Outputs the clock signal to the PLL IC (MAIN unit; IC8, pin 4).
7	PDATA	Outputs data signals to the PLL IC (MAIN unit; IC8, pin 5).
8	WXDEC	Input port for the WX alert decode signal.
9	DSCENC	Outputs the DSC encode signal.
12	BEEP	Outputs beep audio signals. High: While sounds beep audio.
13	PSTB	Outputs strobe signals.for the PLL IC (MAIN unit; IC8, pin 3).
18	ECK	Outputs the clock signal to the EEPROM (IC4, pin 6).
22	DSCDEC	Input port for the DSC decode signal.
23	UNLK	Input port for the PLL unlock signal. Low: While the PLL is unlocked.
24	EDATA	I/O port for the EEPROM data signal.
30	SQL	Input port for the squelch level signal.
31	PTT	Input port for the HM-141 PTT switch. Low: While the PTT switch is pushed.
40	SCAN	Input port for the SCAN switch. Low: While the [SCAN] switch is pushed.
41	CH/WX	Input port for the [CH/WX] switch. Low: While the [CH/WX] switch is pushed.
42	CH16	Input port for the [CH16] switch. Low: While the [CH16] switch is pushed.
43	DN	Input port for the [▼] switch. Low: While the [▼] switch is pushed.
44	UP	Input port for the [▲] switch. Low: While the [▲] switch is pushed.
45	DSC	Input port for the [DSC] switch. Low: While the [DSC] switch is pushed.
46	DTRS	Input port for the [Distress] switch. Low: While the [Distress] switch is pushed.
47	PTTC	Outputs the microphone muting circuit (IC7) control signal. Low: While transmitting the DSC signal.
49	H/L	• Outputs the transmit power control signal. • Outputs the receiver RF attenuator control signal. Low: While the attenuator is ON.
50	RMUTE	Outputs the receiver mute control signal. Low: While muting.
51	TMUTE	Outputs the transmitter mute control signal. High: While muting.
52	SEND	Outputs the T5 regulator (MAIN unit; Q31, Q32) control signal. High: While transmitting
53	RCV	Outputs the R5 regulator (MAIN unit; Q33, Q34) control signal. High: While receiving.
54	BPLVL	Outputs special alarm audio signals (ex. when receiving distress signal). Low: While sounds special alarm.
62–88	SEG1–SEG27	Output LCD segment signals.
92–95	COM3–COM0	Output LCD common signals.

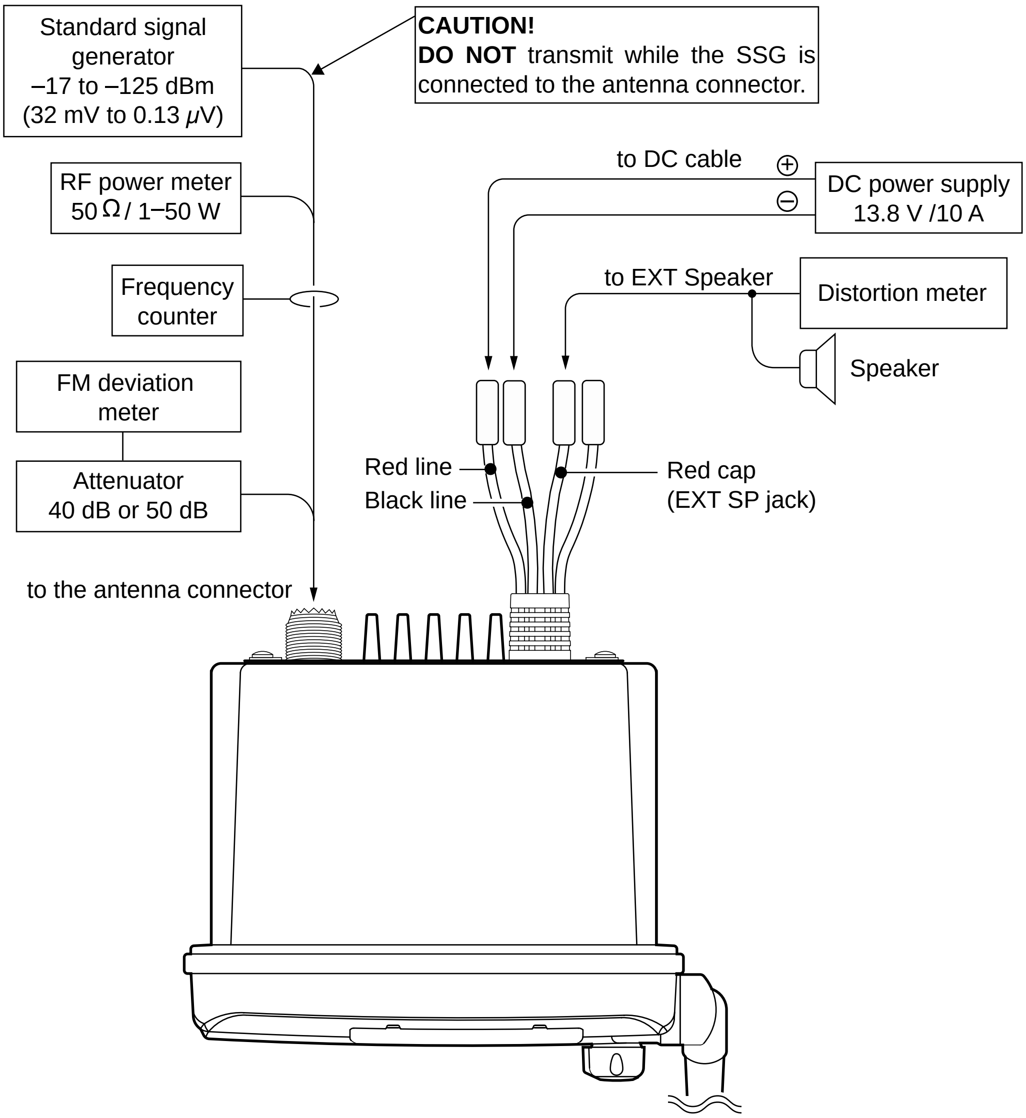
SECTION 5 ADJUSTMENT PROCEDURES

5-1 PREPARATION

■ REQUIRED TEST EQUIPMENT

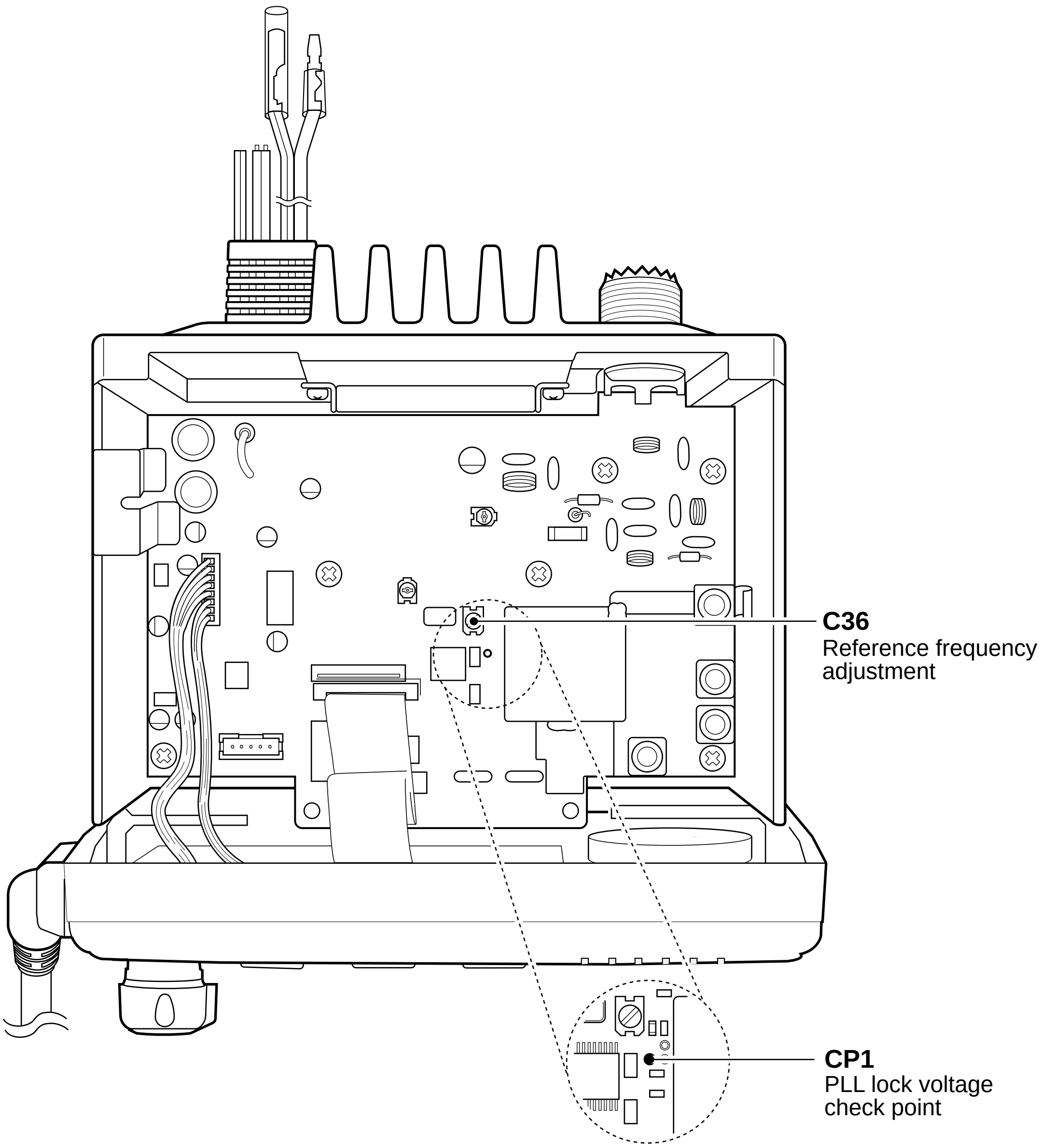
EQUIPMENT	GRADE AND RANGE	EQUIPMENT	GRADE AND RANGE
DC power supply	Output voltage : 13.8 V DC Current capacity : 10 A or more	Audio generator	Frequency range : 300–3000 Hz Measuring range : 1–500 mV
RF power meter (terminated type)	Measuring range : 1–50 W Frequency range : 100–300 MHz Impedance : 50 Ω SWR : Less than 1.2 : 1	Standard signal generator (SSG)	Frequency range : 0.1–300 MHz Output level : 0.1 µV–32 mV (–127 to –17 dBm)
Frequency counter	Frequency range : 0.1–300 MHz Frequency accuracy : ±1 ppm or better Sensitivity : 100 mV or better	Oscilloscope	Frequency range : DC–20 MHz Measuring range : 0.01–20 V
		AC millivoltmeter	Measuring range : 10 mV–10 V
FM deviation meter	Frequency range : 30–300 MHz Measuring range : 0 to ±10 kHz	External speaker	Input impedance : 4 Ω Capacity : 5 W or more
DC voltmeter	Input impedance : 50 kΩ/V DC or better	Attenuator	Power attenuation : 40 or 50 dB Capacity : 50 W or more
Digital multi-meter	Input impedance : 10 MΩ/V DC or better	Dummy load	Resistance : 50 Ω Capacity : 100 W or more
Distortion meter	Frequency range : 1 kHz ±10 % Measuring range : 1–100 %		

■ CONNECTIONS



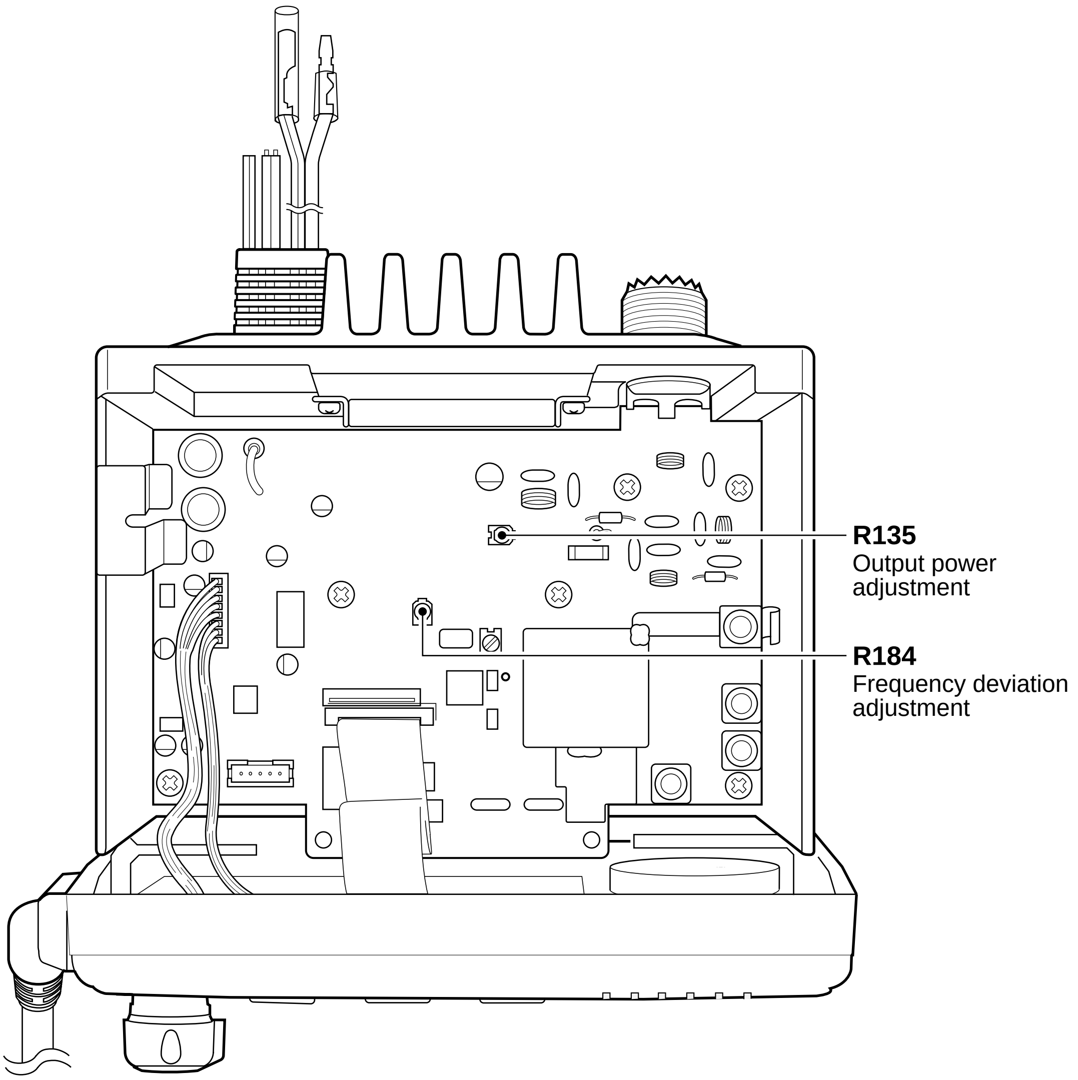
5-2 PLL ADJUSTMENTS

ADJUSTMENT		ADJUSTMENT CONDITION	MEASUREMENT		VALUE	ADJUSTMENT POINT	
			UNIT	LOCATION		UNIT	ADJUST
LOCK VOLTAGE	1	• Operating channel : ch16 • Receiving	MAIN	Connect a digital multi-meter or oscil-loscope to the check point LV.	1.8 V		Verify
	2	• Operating channel : ch16 • Output power : Low • Transmitting			1.6 V		
REFERENCE FREQUENCY	1	• Operating channel : ch16 • Output power : Low • Connect an RF power meter or a 50 Ω dummy load to the antenna connector. • Transmitting	Rear Panel	Loosely couple the frequency counter to the antenna con-nector.	156.8000 MHz	MAIN	C257



5-3 TRANSMITTER ADJUSTMENTS

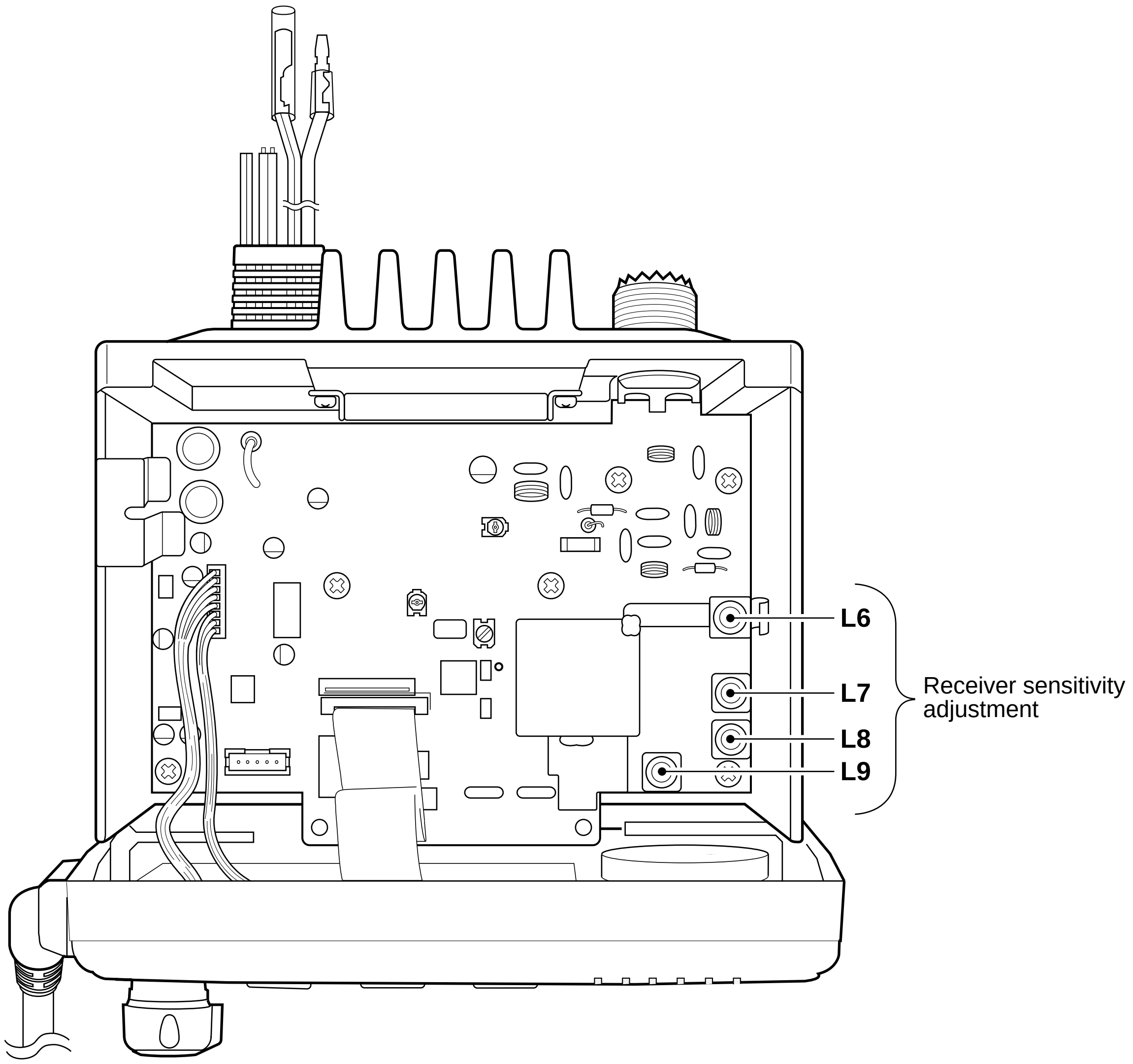
ADJUSTMENT		ADJUSTMENT CONDITION	MEASUREMENT		VALUE	ADJUSTMENT POINT	
			UNIT	LOCATION		UNIT	ADJUST
OUTPUT POWER	1	• Operating channel : ch16 • Output power : High • Transmitting	Rear Panel	Connect an RF power meter to the antenna connector.	23.5 W	MAIN	R135
FREQUENCY DEVIATION	1	• Operating channel : ch16 • Output power : Low • Connect an audio generator to J2 (pin 3) on the MAIN unit with an AC millivoltmeter and set as: Frequency : 1 kHz Level : 40 mV • Set an FM deviation meter as: HPF : OFF LPF : 20 kHz De-emphasis : OFF Detector : (P–P)/2 • Transmitting	Rear Panel	Connect an FM deviation meter to the antenna connector through an attenuator.	±4.3 kHz	MAIN	R184



5-4 RECEIVER ADJUSTMENT

ADJUSTMENT		ADJUSTMENT CONDITION	MEASUREMENT		VALUE	ADJUSTMENT POINT	
			UNIT	LOCATION		UNIT	ADJUST
SENSITIVITY	1	• Operating channel : ch16 • [SQUELCH] control: Max. counterclockwise • Connect an SSG to the antenna connector and set as: Frequency : 156.800 MHz Level : 1 µV* (–107 dBm) Modulation : 1 kHz Deviation : ±3.0 kHz • Receiving	MAIN	• Connect the distortion meter to the [EXT SP] jack with a 4 Ω load. • Connect a DC voltmeter to the check point RSSI.	Maximum voltage	MAIN	L6, L7, L8, L9

*This output level of a standard signal generator (SSG) is indicated as SSG's closed circuit.



SECTION 6 PARTS LIST

6-1 IC-M302

[VR BOARD]

REF NO.	ORDER NO.	DESCRIPTION		M.
R1	7210003140	VARIABLE	TP96N97N-15SK-10KA-2685	T
J1	6510009490	CONNECTOR	S5B-ZR	T
EP1	0910056592	PCB	B 6017B	

[SQL BOARD]

REF NO.	ORDER NO.	DESCRIPTION		M.
R1	7210003150	VARIABLE	TP96N97-15SK-10KB-2685	T
J1	6510009470	CONNECTOR	S3B-ZR	T
EP1	0910056602	PCB	B 6018B	

[FRONT UNIT]

REF NO.	ORDER NO.	DESCRIPTION		M.
MC1	0800007150	MICROPHONE	HM-141B ACC <FG> [Black]	
	0800007160	MICROPHONE	HM-141W ACC <FG> [White]	
	0800007320	MICROPHONE	HM-141G ACC <FG> [Gray]	
SP1	2510001240	SPEAKER	045P0803 <FG>	
W1	7120000470	JUMPER	ERDS2T0	
W2	7120000470	JUMPER	ERDS2T0	
W3	8900012410	CABLE	OPC-1263 (N=30,L=110)	

[LOGIC BOARD]

REF NO.	ORDER NO.	DESCRIPTION		M.
IC1	1140011800	S.IC	M37560MFA-303GP (FX-2685A)	T
IC2	1170000350	S.IC	PC357N6T	T
IC3	1130007430	S.IC	TC7S14FU (TE85R)	T
IC4	1130011570	S.IC	BR24L32FV-WE2	T
IC5	1110006210	S.IC	BD5242FVE-TR	T
IC6	1110002700	S.IC	NJM2904M-TE1	T
Q2	1520000460	S.TRANSISTOR	2SB1132 T100 R	T
Q3	1530002850	S.TRANSISTOR	2SC4116-BL (TE85R)	T
Q4	1530002850	S.TRANSISTOR	2SC4116-BL (TE85R)	T
Q6	1590001050	S.TRANSISTOR	DTC114TUA T106	T
D1	1750000550	S.DIODE	1SS355 TE-17	T
D2	1750000550	S.DIODE	1SS355 TE-17	T
D3	1750000150	S.DIODE	DA204K T146	T
X1	6050011800	S.XTAL	CR-769 (7.9872 MHz)	T

[LOGIC BOARD]

REF NO.	ORDER NO.	DESCRIPTION		M.
R1	7030003530	S.RESISTOR	ERJ3GEYJ 562 V (5.6 kΩ)	T
R3	7030003560	S.RESISTOR	ERJ3GEYJ 103 V (10 kΩ)	T
R4	7030003560	S.RESISTOR	ERJ3GEYJ 103 V (10 kΩ)	T
R5	7030003560	S.RESISTOR	ERJ3GEYJ 103 V (10 kΩ)	T
R14	7030003700	S.RESISTOR	ERJ3GEYJ 154 V (150 kΩ)	T
R15	7030003640	S.RESISTOR	ERJ3GEYJ 473 V (47 kΩ)	T
R16	7030003560	S.RESISTOR	ERJ3GEYJ 103 V (10 kΩ)	T
R21	7030003250	S.RESISTOR	ERJ3GEYJ 270 V (27 Ω)	T
R22	7030003250	S.RESISTOR	ERJ3GEYJ 270 V (27 Ω)	T
R23	7030003250	S.RESISTOR	ERJ3GEYJ 270 V (27 Ω)	T
R24	7030003630	S.RESISTOR	ERJ3GEYJ 393 V (39 kΩ)	T
R25	7030003640	S.RESISTOR	ERJ3GEYJ 473 V (47 kΩ)	T
R26	7030003440	S.RESISTOR	ERJ3GEYJ 102 V (1 kΩ)	T
R27	7030003570	S.RESISTOR	ERJ3GEYJ 123 V (12 kΩ)	T
R28	7030003500	S.RESISTOR	ERJ3GEYJ 332 V (3.3 kΩ)	T
R29	7030003440	S.RESISTOR	ERJ3GEYJ 102 V (1 kΩ)	T
R30	7030003390	S.RESISTOR	ERJ3GEYJ 391 V (390 Ω)	T
R31	7030003390	S.RESISTOR	ERJ3GEYJ 391 V (390 Ω)	T
R35	7030003360	S.RESISTOR	ERJ3GEYJ 221 V (220 Ω)	T
R36	7030003540	S.RESISTOR	ERJ3GEYJ 682 V (6.8 kΩ)	T
R37	7030003580	S.RESISTOR	ERJ3GEYJ 153 V (15 kΩ)	T
R38	7030003440	S.RESISTOR	ERJ3GEYJ 102 V (1 kΩ)	T
R40	7030003340	S.RESISTOR	ERJ3GEYJ 151 V (150 Ω)	T
R41	7030003560	S.RESISTOR	ERJ3GEYJ 103 V (10 kΩ)	T
R42	7030003560	S.RESISTOR	ERJ3GEYJ 103 V (10 kΩ)	T
R43	7030003560	S.RESISTOR	ERJ3GEYJ 103 V (10 kΩ)	T
R51	7030003680	S.RESISTOR	ERJ3GEYJ 104 V (100 kΩ)	T
R52	7030003800	S.RESISTOR	ERJ3GEYJ 105 V (1 MΩ)	T
R53	7030003560	S.RESISTOR	ERJ3GEYJ 103 V (10 kΩ)	T
R54	7030003540	S.RESISTOR	ERJ3GEYJ 682 V (6.8 kΩ)	T
R55	7030003560	S.RESISTOR	ERJ3GEYJ 103 V (10 kΩ)	T
R56	7030003560	S.RESISTOR	ERJ3GEYJ 103 V (10 kΩ)	T
R61	7030003680	S.RESISTOR	ERJ3GEYJ 104 V (100 kΩ)	T
R62	7030003560	S.RESISTOR	ERJ3GEYJ 103 V (10 kΩ)	T
R63	7030003560	S.RESISTOR	ERJ3GEYJ 103 V (10 kΩ)	T
R64	7030003560	S.RESISTOR	ERJ3GEYJ 103 V (10 kΩ)	T
R65	7030003800	S.RESISTOR	ERJ3GEYJ 105 V (1 MΩ)	T
C1	4030006900	S.CERAMIC	C1608 JB 1H 103K-T	T
C2	4030006850	S.CERAMIC	C1608 JB 1H 471K-T	T
C3	4030006900	S.CERAMIC	C1608 JB 1H 103K-T	T
C4	4030006850	S.CERAMIC	C1608 JB 1H 471K-T	T
C5	4030006900	S.CERAMIC	C1608 JB 1H 103K-T	T
C6	4030011600	S.CERAMIC	C1608 JB 1E 104K-T	T
C7	4030006900	S.CERAMIC	C1608 JB 1H 103K-T	T
C11	4030006900	S.CERAMIC	C1608 JB 1H 103K-T	T
C12	4030006860	S.CERAMIC	C1608 JB 1H 102K-T	T
C13	4030006900	S.CERAMIC	C1608 JB 1H 103K-T	T
C14	4030006860	S.CERAMIC	C1608 JB 1H 102K-T	T
C16	4030006880	S.CERAMIC	C1608 JB 1H 472K-T	T
C17	4030006900	S.CERAMIC	C1608 JB 1H 103K-T	T
C18	4030006900	S.CERAMIC	C1608 JB 1H 103K-T	T
C21	4030008880	S.CERAMIC	C1608 JB 1H 223K-T	T
C22	4510005310	S.ELECTROLYTIC	ECEV1CA220SR	T
C23	4030006900	S.CERAMIC	C1608 JB 1H 103K-T	T
C25	4030006900	S.CERAMIC	C1608 JB 1H 103K-T	T
C26	4030006860	S.CERAMIC	C1608 JB 1H 102K-T	T
C31	4030009650	S.CERAMIC	C1608 CH 1H 240J-T	T
C32	4030007050	S.CERAMIC	C1608 CH 1H 220J-T	T
C41	4030006850	S.CERAMIC	C1608 JB 1H 471K-T	T
C42	4030006850	S.CERAMIC	C1608 JB 1H 471K-T	T
C43	4030006860	S.CERAMIC	C1608 JB 1H 102K-T	T
J1	6510021720	S.CONNECTOR	30FLT-SM1-TB	T
J2	6510015540	S.CONNECTOR	B4B-ZR-SM3-TF	T
DS1	5030002590	LCD	IS08251E00V0	B
DS2	5040002310	S.LED	SML-311YTT86	B
DS3	5040002310	S.LED	SML-311YTT86	B
DS4	5040002660	S.LED	FY1101F-TR (LED)	B
DS5	5040002660	S.LED	FY1101F-TR (LED)	B
DS6	5040002660	S.LED	FY1101F-TR (LED)	B
DS7	5040002660	S.LED	FY1101F-TR (LED)	B
EP1	0910057311	PCB	B 6096A	
EP2	8930061040	LCD CONTACT	SRCN-2685-SP-N-W	B

M.=Mounted side (T: Mounted on the Top side, B: Mounted on the Bottom side)

S.=Surface mount

[MAIN UNIT]

REF NO.	ORDER NO.	DESCRIPTION		M.
IC1	1110003490	S.IC	TA31136FN (D,EL)	T
IC2	1110005320	S.IC	NJM13403V-TE1	T
IC3	1110003650	S.IC	NJM2211M-TE1	T
IC4	1150002170	IC	S-AV35 (I)	T
IC6	1110003090	IC	LA4425A	T
IC7	1140003830	S.IC	TC4W66F (TE12L)	T
IC8	1130007610	S.IC	µPD3140GS-E1 (DS8)	T
IC9	1110002020	IC	TA7805S	T
Q1	1580000540	S.FET	3SK131-T2-LA	T
Q2	1580000540	S.FET	3SK131-T2-LA	T
Q4	1530002600	S.TRANSISTOR	2SC4215-O (TE85R)	T
Q5	1530002850	S.TRANSISTOR	2SC4116-BL (TE85R)	T
Q11	1530002850	S.TRANSISTOR	2SC4116-BL (TE85R)	T
Q12	1590000430	S.TRANSISTOR	DTC144EUA T106	T
Q13	1530002920	S.TRANSISTOR	2SC4226-T1 R25	T
Q14	1530002920	S.TRANSISTOR	2SC4226-T1 R25	T
Q15	1530002600	S.TRANSISTOR	2SC4215-O (TE85R)	T
Q16	1530002600	S.TRANSISTOR	2SC4215-O (TE85R)	T
Q17	1530002600	S.TRANSISTOR	2SC4215-O (TE85R)	T
Q18	1530002920	S.TRANSISTOR	2SC4226-T1 R25	T
Q20	1590000430	S.TRANSISTOR	DTC144EUA T106	T
Q21	1590000670	S.TRANSISTOR	FMW1 T148	T
Q22	1590000680	S.TRANSISTOR	DTC114EUA T106	T
Q23	1510000920	S.TRANSISTOR	2SA1577 T106 Q	T
Q25	1590000430	S.TRANSISTOR	DTC144EUA T106	T
Q26	1530002600	S.TRANSISTOR	2SC4215-O (TE85R)	T
Q31	1510000920	S.TRANSISTOR	2SA1577 T106 Q	T
Q32	1590000430	S.TRANSISTOR	DTC144EUA T106	T
Q33	1510000920	S.TRANSISTOR	2SA1577 T106 Q	T
Q34	1590000430	S.TRANSISTOR	DTC144EUA T106	T
Q35	1520000460	S.TRANSISTOR	2SB1132 T100 R	T
Q36	1530002850	S.TRANSISTOR	2SC4116-BL (TE85R)	T
D1	1710001080	DIODE	XB15A308	T
D2	1710001080	DIODE	XB15A308	T
D4	1720000260	S.VARICAP	1SV214 (TPH2)	T
D5	1720000260	S.VARICAP	1SV214 (TPH2)	T
D6	1720000260	S.VARICAP	1SV214 (TPH2)	T
D7	1720000260	S.VARICAP	1SV214 (TPH2)	T
D9	1750000470	S.DIODE	1SS321 (TE85R)	T
D11	1790000620	S.DIODE	MA77 (TX)	T
D12	1790000620	S.DIODE	MA77 (TX)	T
D13	1750000710	S.VARICAP	HVC350BTRF	T
D14	1750000710	S.VARICAP	HVC350BTRF	T
D16	1790000620	S.DIODE	MA77 (TX)	T
D17	1790000620	S.DIODE	MA77 (TX)	T
D21	1790000690	S.DIODE	HSM88ASR-TR	T
D22	1790000690	S.DIODE	HSM88ASR-TR	T
D25	1790000700	DIODE	DSA3A1	T
D26	1750000150	S.DIODE	DA204K T146	T
FI1	2030000270	MONOLITH	FL-363 (21.7 MHz)	T
FI2	2030000270	MONOLITH	FL-363 (21.7 MHz)	T
FI3	2020001680	CERAMIC	ALFY450E	T
X1	6070000200	DISCRIMINATOR	CDBLA450KCAY24-B0 (CDB450C24)	T
X2	6050011760	S.XTAL	CR-768 (21.250 MHz)	T
L1	6110001600	COIL	LA-243	T
L2	6110001600	COIL	LA-243	T
L3	6110001600	COIL	LA-243	T
L6	6150003820	COIL	LS-440	T
L7	6150003820	COIL	LS-440	T
L8	6150003820	COIL	LS-440	T
L9	6150003820	COIL	LS-440	T
L10	6200010090	S.COIL	ELJND R82JF	T
L12	6200009620	S.COIL	MLG1608B 68NJ-T	T
L13	6200009620	S.COIL	MLG1608B 68NJ-T	T
L21	6200003710	S.COIL	NL 252018T-2R7J	T
L22	6200008190	S.COIL	0.25-1.9-8TL 80N	T
L23	6200009560	S.COIL	MLG1608B R10J-T	T
L26	6200009560	S.COIL	MLG1608B R10J-T	T
L28	6200009680	S.COIL	MLG1608B 47NJ-T	T
L29	6200009680	S.COIL	MLG1608B 47NJ-T	T
L31	6110001670	COIL	LA-253	T
L32	6170000230	COIL	LW-25	T
L35	6200009560	S.COIL	MLG1608B R10J-T	T
L36	6200009560	S.COIL	MLG1608B R10J-T	T
R4	7030003680	S.RESISTOR	ERJ3GEYJ 104 V (100 kΩ)	T
R5	7030003630	S.RESISTOR	ERJ3GEYJ 393 V (39 kΩ)	T

[MAIN UNIT]

REF NO.	ORDER NO.	DESCRIPTION		M.
R6	7030003640	S.RESISTOR	ERJ3GEYJ 473 V (47 kΩ)	T
R7	7030003410	S.RESISTOR	ERJ3GEYJ 561 V (560 Ω)	T
R8	7030004050	S.RESISTOR	ERJ3GEYJ 1R0 V (1 Ω)	T
R9	7030003680	S.RESISTOR	ERJ3GEYJ 104 V (100 kΩ)	T
R10	7030003260	S.RESISTOR	ERJ3GEYJ 330 V (33 Ω)	T
R12	7030003680	S.RESISTOR	ERJ3GEYJ 104 V (100 kΩ)	T
R14	7030003680	S.RESISTOR	ERJ3GEYJ 104 V (100 kΩ)	T
R16	7030003680	S.RESISTOR	ERJ3GEYJ 104 V (100 kΩ)	T
R21	7030003320	S.RESISTOR	ERJ3GEYJ 101 V (100 Ω)	T
R25	7030003820	S.RESISTOR	ERJ3GEYJ 155 V (1.5 MΩ)	T
R26	7030003640	S.RESISTOR	ERJ3GEYJ 473 V (47 kΩ)	T
R27	7030003600	S.RESISTOR	ERJ3GEYJ 223 V (22 kΩ)	T
R28	7030003560	S.RESISTOR	ERJ3GEYJ 103 V (10 kΩ)	T
R31	7030003200	S.RESISTOR	ERJ3GEYJ 100 V (10 Ω)	T
R32	7030003540	S.RESISTOR	ERJ3GEYJ 682 V (6.8 kΩ)	T
R33	7030003450	S.RESISTOR	ERJ3GEYJ 122 V (1.2 kΩ)	T
R34	7030003450	S.RESISTOR	ERJ3GEYJ 122 V (1.2 kΩ)	T
R35	7030003680	S.RESISTOR	ERJ3GEYJ 104 V (100 kΩ)	T
R36	7030003460	S.RESISTOR	ERJ3GEYJ 152 V (1.5 kΩ)	T
R37	7030003400	S.RESISTOR	ERJ3GEYJ 471 V (470 Ω)	T
R38	7030003480	S.RESISTOR	ERJ3GEYJ 222 V (2.2 kΩ)	T
R41	7030003660	S.RESISTOR	ERJ3GEYJ 683 V (68 kΩ)	T
R42	7030003400	S.RESISTOR	ERJ3GEYJ 471 V (470 Ω)	T
R43	7030003440	S.RESISTOR	ERJ3GEYJ 102 V (1 kΩ)	T
R44	7030003390	S.RESISTOR	ERJ3GEYJ 391 V (390 Ω)	T
R45	7030003560	S.RESISTOR	ERJ3GEYJ 103 V (10 kΩ)	T
R46	7030003460	S.RESISTOR	ERJ3GEYJ 152 V (1.5 kΩ)	T
R47	7510001510	S.THERMISTOR	NTCG16 4LH 223KT	T
R48	7030003640	S.RESISTOR	ERJ3GEYJ 473 V (47 kΩ)	T
R49	7030003440	S.RESISTOR	ERJ3GEYJ 102 V (1 kΩ)	T
R50	7030003730	S.RESISTOR	ERJ3GEYJ 274 V (270 kΩ)	T
R51	7030003460	S.RESISTOR	ERJ3GEYJ 152 V (1.5 kΩ)	T
R53	7030003680	S.RESISTOR	ERJ3GEYJ 104 V (100 kΩ)	T
R55	7030003560	S.RESISTOR	ERJ3GEYJ 103 V (10 kΩ)	T
R56	7030003560	S.RESISTOR	ERJ3GEYJ 103 V (10 kΩ)	T
R57	7030003560	S.RESISTOR	ERJ3GEYJ 103 V (10 kΩ)	T
R58	7030003560	S.RESISTOR	ERJ3GEYJ 103 V (10 kΩ)	T
R61	7030003580	S.RESISTOR	ERJ3GEYJ 153 V (15 kΩ)	T
R62	7030003580	S.RESISTOR	ERJ3GEYJ 153 V (15 kΩ)	T
R63	7030003440	S.RESISTOR	ERJ3GEYJ 102 V (1 kΩ)	T
R64	7030003760	S.RESISTOR	ERJ3GEYJ 474 V (470 kΩ)	T
R65	7030003700	S.RESISTOR	ERJ3GEYJ 154 V (150 kΩ)	T
R66	7030003490	S.RESISTOR	ERJ3GEYJ 272 V (2.7 kΩ)	T
R67	7030003390	S.RESISTOR	ERJ3GEYJ 391 V (390 Ω)	T
R68	7030003860	S.RESISTOR	ERJ3GE JPW V	T
R71	7030003280	S.RESISTOR	ERJ3GEYJ 470 V (47 Ω)	T
R72	7030003760	S.RESISTOR	ERJ3GEYJ 474 V (470 kΩ)	T
R73	7030003640	S.RESISTOR	ERJ3GEYJ 473 V (47 kΩ)	T
R74	7030003680	S.RESISTOR	ERJ3GEYJ 104 V (100 kΩ)	T
R75	7030003630	S.RESISTOR	ERJ3GEYJ 393 V (39 kΩ)	T
R76	7030003580	S.RESISTOR	ERJ3GEYJ 153 V (15 kΩ)	T
R78	7030003480	S.RESISTOR	ERJ3GEYJ 222 V (2.2 kΩ)	T
R81	7030003440	S.RESISTOR	ERJ3GEYJ 102 V (1 kΩ)	T
R82	7030003440	S.RESISTOR	ERJ3GEYJ 102 V (1 kΩ)	T
R83	7030003410	S.RESISTOR	ERJ3GEYJ 561 V (560 Ω)	T
R84	7030003640	S.RESISTOR	ERJ3GEYJ 473 V (47 kΩ)	T
R85	7030003360	S.RESISTOR	ERJ3GEYJ 221 V (220 Ω)	T
R86	7030003320	S.RESISTOR	ERJ3GEYJ 101 V (100 Ω)	T
R87	7030003620	S.RESISTOR	ERJ3GEYJ 333 V (33 kΩ)	T
R88	7030003600	S.RESISTOR	ERJ3GEYJ 223 V (22 kΩ)	T
R89	7030003680	S.RESISTOR	ERJ3GEYJ 104 V (100 kΩ)	T
R91	7030003320	S.RESISTOR	ERJ3GEYJ 101 V (100 Ω)	T
R92	7030003390	S.RESISTOR	ERJ3GEYJ 391 V (390 Ω)	T
R93	7030003550	S.RESISTOR	ERJ3GEYJ 822 V (8.2 kΩ)	T
R94	7030003350	S.RESISTOR	ERJ3GEYJ 181 V (180 Ω)	T
R95	7030003550	S.RESISTOR	ERJ3GEYJ 822 V (8.2 kΩ)	T
R96	7030003420	S.RESISTOR	ERJ3GEYJ 681 V (680 Ω)	T
R97	7030003660	S.RESISTOR	ERJ3GEYJ 683 V (68 kΩ)	T
R102	7030003320	S.RESISTOR	ERJ3GEYJ 101 V (100 Ω)	T
R103	7030003620	S.RESISTOR	ERJ3GEYJ 333 V (33 kΩ)	T
R106	7030003440	S.RESISTOR	ERJ3GEYJ 102 V (1 kΩ)	T
R107	7030003270	S.RESISTOR	ERJ3GEYJ 390 V (39 Ω)	T
R108	7030003480	S.RESISTOR	ERJ3GEYJ 222 V (2.2 kΩ)	T
R109	7030003390	S.RESISTOR	ERJ3GEYJ 391 V (390 Ω)	T
R110	7030003200	S.RESISTOR	ERJ3GEYJ 100 V (10 Ω)	T
R111	7030003560	S.RESISTOR	ERJ3GEYJ 103 V (10 kΩ)	T
R112	7030003560	S.RESISTOR	ERJ3GEYJ 103 V (10 kΩ)	T
R113	7030003280	S.RESISTOR	ERJ3GEYJ 470 V (47 Ω)	T
R116	7030003440	S.RESISTOR	ERJ3GEYJ 102 V (1 kΩ)	T
R117	7030003320	S.RESISTOR	ERJ3GEYJ 101 V (100 Ω)	T
R122	7030003200	S.RESISTOR	ERJ3GEYJ 100 V (10 Ω)	T
R123	7030003440	S.RESISTOR	ERJ3GEYJ 102 V (1 kΩ)	T
R124	7030003340	S.RESISTOR	ERJ3GEYJ 151 V (150 Ω)	T
R126	7030003720	S.RESISTOR	ERJ3GEYJ 224 V (220 kΩ)	T
R127	7030000340	S.RESISTOR	MCR10EZHJ 470 Ω (471)	T
R130	7030001110	S.RESISTOR	MCR50JZHJ 68 Ω (680)	T
R131	7030000420	S.RESISTOR	MCR10EZHJ 2.2 kΩ	T
R132	7030000420	S.RESISTOR	MCR10EZHJ 2.2 kΩ	T

M.=Mounted side (T: Mounted on the Top side, B: Mounted on the Bottom side)

S.=Surface mount

[MAIN UNIT]

REF NO.	ORDER NO.	DESCRIPTION		M.
R133	7030003680	S.RESISTOR	ERJ3GEYJ 104 V (100 kΩ)	T
R135	7310002670	S.TRIMMER	RV-143 (RH03A3AS2) 471	T
R136	7030003590	S.RESISTOR	ERJ3GEYJ 183 V (18 kΩ)	T
R137	7030003320	S.RESISTOR	ERJ3GEYJ 101 V (100 Ω)	T
R138	7030003560	S.RESISTOR	ERJ3GEYJ 103 V (10 kΩ)	T
R139	7030003360	S.RESISTOR	ERJ3GEYJ 221 V (220 Ω)	T
R140	7030003560	S.RESISTOR	ERJ3GEYJ 103 V (10 kΩ)	T
R141	7030003500	S.RESISTOR	ERJ3GEYJ 332 V (3.3 kΩ)	T
R142	7030003510	S.RESISTOR	ERJ3GEYJ 392 V (3.9 kΩ)	T
R143	7510001710	S.THEMISTOR	TN10-3C471JT	T
R144	7030003520	S.RESISTOR	ERJ3GEYJ 472 V (4.7 kΩ)	T
R151	7030003320	S.RESISTOR	ERJ3GEYJ 101 V (100 Ω)	T
R152	7030000100	S.RESISTOR	MCR10EZHJ 4.7 Ω (4R7)	T
R153	7030003580	S.RESISTOR	ERJ3GEYJ 153 V (15 kΩ)	T
R154	7030003450	S.RESISTOR	ERJ3GEYJ 122 V (1.2 kΩ)	T
R155	7030003800	S.RESISTOR	ERJ3GEYJ 105 V (1 MΩ)	T
R156	7030003600	S.RESISTOR	ERJ3GEYJ 223 V (22 kΩ)	T
R157	7030003560	S.RESISTOR	ERJ3GEYJ 103 V (10 kΩ)	T
R161	7030003800	S.RESISTOR	ERJ3GEYJ 105 V (1 MΩ)	T
R162	7030003800	S.RESISTOR	ERJ3GEYJ 105 V (1 MΩ)	T
R163	7030003800	S.RESISTOR	ERJ3GEYJ 105 V (1 MΩ)	T
R164	7030003680	S.RESISTOR	ERJ3GEYJ 104 V (100 kΩ)	T
R165	7030003490	S.RESISTOR	ERJ3GEYJ 272 V (2.7 kΩ)	T
R166	7030003680	S.RESISTOR	ERJ3GEYJ 104 V (100 kΩ)	T
R167	7030003480	S.RESISTOR	ERJ3GEYJ 222 V (2.2 kΩ)	T
R168	7030003720	S.RESISTOR	ERJ3GEYJ 224 V (220 kΩ)	T
R169	7030003560	S.RESISTOR	ERJ3GEYJ 103 V (10 kΩ)	T
R170	7030003680	S.RESISTOR	ERJ3GEYJ 104 V (100 kΩ)	T
R171	7030003560	S.RESISTOR	ERJ3GEYJ 103 V (10 kΩ)	T
R172	7030003800	S.RESISTOR	ERJ3GEYJ 105 V (1 MΩ)	T
R173	7030003520	S.RESISTOR	ERJ3GEYJ 472 V (4.7 kΩ)	T
R174	7030003600	S.RESISTOR	ERJ3GEYJ 223 V (22 kΩ)	T
R175	7030003680	S.RESISTOR	ERJ3GEYJ 104 V (100 kΩ)	T
R176	7030003590	S.RESISTOR	ERJ3GEYJ 183 V (18 kΩ)	T
R177	7030003660	S.RESISTOR	ERJ3GEYJ 683 V (68 kΩ)	T
R178	7030003660	S.RESISTOR	ERJ3GEYJ 683 V (68 kΩ)	T
R179	7030003660	S.RESISTOR	ERJ3GEYJ 683 V (68 kΩ)	T
R180	7030003610	S.RESISTOR	ERJ3GEYJ 273 V (27 kΩ)	T
R181	7510001670	S.THRMISTOR	NTCG16 4BH 103KT	T
R182	7030003520	S.RESISTOR	ERJ3GEYJ 472 V (4.7 kΩ)	T
R183	7030003600	S.RESISTOR	ERJ3GEYJ 223 V (22 kΩ)	T
R184	7310002600	S.TRIMMER	RV-110 (RH03A3AS4X0AA) 473	T
R185	7030003610	S.RESISTOR	ERJ3GEYJ 273 V (27 kΩ)	T
R188	7030003280	S.RESISTOR	ERJ3GEYJ 470 V (47 Ω)	T
R189	7030003550	S.RESISTOR	ERJ3GEYJ 822 V (8.2 kΩ)	T
R190	7030003570	S.RESISTOR	ERJ3GEYJ 123 V (12 kΩ)	T
R191	7030003570	S.RESISTOR	ERJ3GEYJ 123 V (12 kΩ)	T
R201	7030003400	S.RESISTOR	ERJ3GEYJ 471 V (470 Ω)	T
R202	7030003660	S.RESISTOR	ERJ3GEYJ 683 V (68 kΩ)	T
R203	7030003320	S.RESISTOR	ERJ3GEYJ 101 V (100 Ω)	T
R204	7030003860	S.RESISTOR	ERJ3GE JPW V	T
R210	7030003280	S.RESISTOR	ERJ3GEYJ 470 V (47 Ω)	T
R211	7030003440	S.RESISTOR	ERJ3GEYJ 102 V (1 kΩ)	T
R212	7030003200	S.RESISTOR	ERJ3GEYJ 100 V (10 Ω)	T
R213	7030003480	S.RESISTOR	ERJ3GEYJ 222 V (2.2 kΩ)	T
R214	7030003380	S.RESISTOR	ERJ3GEYJ 331 V (330 Ω)	T
R215	7030003380	S.RESISTOR	ERJ3GEYJ 331 V (330 Ω)	T
R216	7030003500	S.RESISTOR	ERJ3GEYJ 332 V (3.3 kΩ)	T
R221	7030003560	S.RESISTOR	ERJ3GEYJ 103 V (10 kΩ)	T
R222	7030003480	S.RESISTOR	ERJ3GEYJ 222 V (2.2 kΩ)	T
R223	7030003560	S.RESISTOR	ERJ3GEYJ 103 V (10 kΩ)	T
R224	7030003480	S.RESISTOR	ERJ3GEYJ 222 V (2.2 kΩ)	T
R225	7030003510	S.RESISTOR	ERJ3GEYJ 392 V (3.9 kΩ)	T
R226	7030003520	S.RESISTOR	ERJ3GEYJ 472 V (4.7 kΩ)	T
C3	4010007630	CERAMIC	HM60SJ CH 270J 500V	T
C4	4010005420	CERAMIC	HM60SJ CH 040C 500V	T
C5	4010008050	CERAMIC	HM60SJ CH 180J 500V	T
C6	4010005790	CERAMIC	HM60SJ YB 102K 500V	T
C7	4010007630	CERAMIC	HM60SJ CH 270J 500V	T
C8	4010008070	CERAMIC	HM60SJ CH 220J 500V	T
C12	4030006990	S.CERAMIC	C1608 CH 1H 080D-T	T
C13	4030007010	S.CERAMIC	C1608 CH 1H 100D-T	T
C14	4030007010	S.CERAMIC	C1608 CH 1H 100D-T	T
C15	4030009920	S.CERAMIC	C1608 CH 1H 050B-T	T
C16	4030006860	S.CERAMIC	C1608 JB 1H 102K-T	T
C17	4030011600	S.CERAMIC	C1608 JB 1E 104K-T	T
C18	4030006900	S.CERAMIC	C1608 JB 1H 103K-T	T
C19	4030006860	S.CERAMIC	C1608 JB 1H 102K-T	T
C20	4030011600	S.CERAMIC	C1608 JB 1E 104K-T	T
C21	4030009530	S.CERAMIC	C1608 CH 1H 030B-T	T
C22	4030007010	S.CERAMIC	C1608 CH 1H 100D-T	T
C23	4030006860	S.CERAMIC	C1608 JB 1H 102K-T	T
C24	4030009530	S.CERAMIC	C1608 CH 1H 030B-T	T
C25	4030009520	S.CERAMIC	C1608 CH 1H 020B-T	T
C26	4030007010	S.CERAMIC	C1608 CH 1H 100D-T	T
C28	4030011600	S.CERAMIC	C1608 JB 1E 104K-T	T

[MAIN UNIT]

REF NO.	ORDER NO.	DESCRIPTION		M.
C29	4030009500	S.CERAMIC	C1608 CH 1H 0R5B-T	T
C30	4030009520	S.CERAMIC	C1608 CH 1H 020B-T	T
C31	4030007010	S.CERAMIC	C1608 CH 1H 100D-T	T
C32	4030009530	S.CERAMIC	C1608 CH 1H 030B-T	T
C34	4030009910	S.CERAMIC	C1608 CH 1H 040B-T	T
C35	4030006850	S.CERAMIC	C1608 JB 1H 471K-T	T
C36	4030006860	S.CERAMIC	C1608 JB 1H 102K-T	T
C42	4030009520	S.CERAMIC	C1608 CH 1H 020B-T	T
C44	4030006860	S.CERAMIC	C1608 JB 1H 102K-T	T
C46	4030006860	S.CERAMIC	C1608 JB 1H 102K-T	T
C47	4030007100	S.CERAMIC	C1608 CH 1H 560J-T	T
C48	4030007010	S.CERAMIC	C1608 CH 1H 100D-T	T
C49	4030006860	S.CERAMIC	C1608 JB 1H 102K-T	T
C50	4030011600	S.CERAMIC	C1608 JB 1E 104K-T	T
C51	4030006900	S.CERAMIC	C1608 JB 1H 103K-T	T
C55	4030009920	S.CERAMIC	C1608 CH 1H 050B-T	T
C59	4030006860	S.CERAMIC	C1608 JB 1H 102K-T	T
C60	4030006900	S.CERAMIC	C1608 JB 1H 103K-T	T
C61	4030008920	S.CERAMIC	C1608 JB 1H 473K-T	T
C63	4030011600	S.CERAMIC	C1608 JB 1E 104K-T	T
C64	4030006860	S.CERAMIC	C1608 JB 1H 102K-T	T
C65	4030006860	S.CERAMIC	C1608 JB 1H 102K-T	T
C67	4030007130	S.CERAMIC	C1608 CH 1H 101J-T	T
C68	4510004630	S.ELECTROLYTIC	ECEV1CA100SR	T
C70	4030006860	S.CERAMIC	C1608 JB 1H 102K-T	T
C71	4030006900	S.CERAMIC	C1608 JB 1H 103K-T	T
C72	4030011600	S.CERAMIC	C1608 JB 1E 104K-T	T
C73	4030007170	S.CERAMIC	C1608 CH 1H 221J-T	T
C74	4030007170	S.CERAMIC	C1608 CH 1H 221J-T	T
C75	4030011600	S.CERAMIC	C1608 JB 1E 104K-T	T
C76	4030011600	S.CERAMIC	C1608 JB 1E 104K-T	T
C77	4030006860	S.CERAMIC	C1608 JB 1H 102K-T	T
C80	4030006860	S.CERAMIC	C1608 JB 1H 102K-T	T
C82	4030011600	S.CERAMIC	C1608 JB 1E 104K-T	T
C83	4030009880	S.CERAMIC	C1608 JB 1H 682K-T	T
C84	4030006850	S.CERAMIC	C1608 JB 1H 471K-T	T
C85	4030006900	S.CERAMIC	C1608 JB 1H 103K-T	T
C88	4030011600	S.CERAMIC	C1608 JB 1E 104K-T	T
C89	4030011600	S.CERAMIC	C1608 JB 1E 104K-T	T
C90	4030008880	S.CERAMIC	C1608 JB 1H 223K-T	T
C91	4030008880	S.CERAMIC	C1608 JB 1H 223K-T	T
C92	4510004630	S.ELECTROLYTIC	ECEV1CA100SR	T
C93	4030011810	S.CERAMIC	C1608 JB 1A 224K-T	T
C95	4510004630	S.ELECTROLYTIC	ECEV1CA100SR	T
C96	4030011600	S.CERAMIC	C1608 JB 1E 104K-T	T
C97	4030008920	S.CERAMIC	C1608 JB 1H 473K-T	T
C99	4340000180	S.MYLAR	ECHU 1C 333JB5	T
C100	4030011600	S.CERAMIC	C1608 JB 1E 104K-T	T
C101	4030006870	S.CERAMIC	C1608 JB 1H 222K-T	T
C102	4030006900	S.CERAMIC	C1608 JB 1H 103K-T	T
C103	4030011810	S.CERAMIC	C1608 JB 1A 224K-T	T
C111	4510004630	S.ELECTROLYTIC	ECEV1CA100SR	T
C112	4030006860	S.CERAMIC	C1608 JB 1H 102K-T	T
C113	4550006130	S.TANTALUM	ECST1VY224R	T
C114	4030006860	S.CERAMIC	C1608 JB 1H 102K-T	T
C115	4030007090	S.CERAMIC	C1608 CH 1H 470J-T	T
C116	4030007080	S.CERAMIC	C1608 CH 1H 390J-T	T
C117	4030006850	S.CERAMIC	C1608 JB 1H 471K-T	T
C119	4030006860	S.CERAMIC	C1608 JB 1H 102K-T	T
C120	4030006850	S.CERAMIC	C1608 JB 1H 471K-T	T
C121	4030006900	S.CERAMIC	C1608 JB 1H 103K-T	T
C122	4030017490	S.CERAMIC	C1608 JB 1A 105K-T	T
C124	4030006860	S.CERAMIC	C1608 JB 1H 102K-T	T
C125	4030009540	S.CERAMIC	C1608 CH 1H 1R5B-T	T
C126	4030006860	S.CERAMIC	C1608 JB 1H 102K-T	T
C127	4030009540	S.CERAMIC	C1608 CH 1H 1R5B-T	T
C128	4030009500	S.CERAMIC	C1608 CH 1H 0R5B-T	T
C129	4030006860	S.CERAMIC	C1608 JB 1H 102K-T	T
C130	4030006900	S.CERAMIC	C1608 JB 1H 103K-T	T
C135	4030011770	S.CERAMIC	C1608 CH 1H 060B-T	T
C136	4030006860	S.CERAMIC	C1608 JB 1H 102K-T	T
C138	4030007050	S.CERAMIC	C1608 CH 1H 220J-T	T
C139	4030006860	S.CERAMIC	C1608 JB 1H 102K-T	T
C140	4030007090	S.CERAMIC	C1608 CH 1H 470J-T	T
C145	4030006860	S.CERAMIC	C1608 JB 1H 102K-T	T
C146	4030006860	S.CERAMIC	C1608 JB 1H 102K-T	T
C147	4030007090	S.CERAMIC	C1608 CH 1H 470J-T	T
C148	4030006860	S.CERAMIC	C1608 JB 1H 102K-T	T
C149	4030007050	S.CERAMIC	C1608 CH 1H 220J-T	T
C151	4030006860	S.CERAMIC	C1608 JB 1H 102K-T	T
C152	4030009530	S.CERAMIC	C1608 CH 1H 030B-T	T
C153	4030007090	S.CERAMIC	C1608 CH 1H 470J-T	T
C154	4030006860	S.CERAMIC	C1608 JB 1H 102K-T	T
C156	4030007050	S.CERAMIC	C1608 CH 1H 220J-T	T
C161	4550006700	S.TANTALUM	ECST1AY106R	T
C162	4030006860	S.CERAMIC	C1608 JB 1H 102K-T	T
C164	4030006850	S.CERAMIC	C1608 JB 1H 471K-T	T
C165	4030006850	S.CERAMIC	C1608 JB 1H 471K-T	T

M.=Mounted side (T: Mounted on the Top side, B: Mounted on the Bottom side)

S.=Surface mount

[MAIN UNIT]

REF NO.	ORDER NO.	DESCRIPTION		M.
C166	4030006860	S.CERAMIC	C1608 JB 1H 102K-T	T
C167	4510005310	S.ELECTROLYTIC	ECEV1CA220SR	T
C171	4010008050	CERAMIC	HM60SJ CH 180J 500V	T
C172	4030006860	S.CERAMIC	C1608 JB 1H 102K-T	T
C173	4030006860	S.CERAMIC	C1608 JB 1H 102K-T	T
C174	4010005430	CERAMIC	HM60SJ CH 050C 500V	T
C175	4030006860	S.CERAMIC	C1608 JB 1H 102K-T	T
C176	4030006860	S.CERAMIC	C1608 JB 1H 102K-T	T
C177	4030006900	S.CERAMIC	C1608 JB 1H 103K-T	T
C178	4030006860	S.CERAMIC	C1608 JB 1H 102K-T	T
C179	4030006850	S.CERAMIC	C1608 JB 1H 471K-T	T
C180	4030006860	S.CERAMIC	C1608 JB 1H 102K-T	T
C181	4030006860	S.CERAMIC	C1608 JB 1H 102K-T	T
C182	4030006850	S.CERAMIC	C1608 JB 1H 471K-T	T
C183	4030006900	S.CERAMIC	C1608 JB 1H 103K-T	T
C185	4030006860	S.CERAMIC	C1608 JB 1H 102K-T	T
C198	4030007130	S.CERAMIC	C1608 CH 1H 101J-T	T
C199	4030006850	S.CERAMIC	C1608 JB 1H 471K-T	T
C201	4030007050	S.CERAMIC	C1608 CH 1H 220J-T	T
C202	4030007130	S.CERAMIC	C1608 CH 1H 101J-T	T
C203	4030006850	S.CERAMIC	C1608 JB 1H 471K-T	T
C205	4030006860	S.CERAMIC	C1608 JB 1H 102K-T	T
C206	4030006850	S.CERAMIC	C1608 JB 1H 471K-T	T
C207	4030006860	S.CERAMIC	C1608 JB 1H 102K-T	T
C208	4030006860	S.CERAMIC	C1608 JB 1H 102K-T	T
C211	4510004590	ELECTROLYTIC	16 MV 470 HC	T
C212	4030011600	S.CERAMIC	C1608 JB 1E 104K-T	T
C213	4510004590	S.ELECTROLYTIC	16 MV 470 HC	T
C214	4030011600	S.CERAMIC	C1608 JB 1E 104K-T	T
C215	4030006900	S.CERAMIC	C1608 JB 1H 103K-T	T
C216	4030017490	S.CERAMIC	C1608 JB 1A 105K-T	T
C217	4030006860	S.CERAMIC	C1608 JB 1H 102K-T	T
C220	4030011810	S.CERAMIC	C1608 JB 1A 224K-T	T
C221	4030006860	S.CERAMIC	C1608 JB 1H 102K-T	T
C222	4030006900	S.CERAMIC	C1608 JB 1H 103K-T	T
C223	4030006870	S.CERAMIC	C1608 JB 1H 222K-T	T
C224	4030007110	S.CERAMIC	C1608 CH 1H 680J-T	T
C226	4030011600	S.CERAMIC	C1608 JB 1E 104K-T	T
C227	4510004630	S.ELECTROLYTIC	ECEV1CA100SR	T
C229	4030011600	S.CERAMIC	C1608 JB 1E 104K-T	T
C230	4510004630	S.ELECTROLYTIC	ECEV1CA100SR	T
C231	4030011600	S.CERAMIC	C1608 JB 1E 104K-T	T
C232	4030009580	S.CERAMIC	C1608 JB 1H 681K-T	T
C233	4030010770	S.CERAMIC	C1608 JB 1H 392K-T	T
C234	4030007130	S.CERAMIC	C1608 CH 1H 101J-T	T
C235	4030008470	S.CERAMIC	C1608 JB 1H 272K-T	T
C236	4030006850	S.CERAMIC	C1608 JB 1H 471K-T	T
C241	4030009920	S.CERAMIC	C1608 CH 1H 050B-T	T
C242	4030006860	S.CERAMIC	C1608 JB 1H 102K-T	T
C243	4030007050	S.CERAMIC	C1608 CH 1H 220J-T	T
C244	4030007050	S.CERAMIC	C1608 CH 1H 220J-T	T
C245	4030007050	S.CERAMIC	C1608 CH 1H 220J-T	T
C246	4030006860	S.CERAMIC	C1608 JB 1H 102K-T	T
C247	4550006540	S.TANTALUM	ECST1CY475R	T
C248	4030011600	S.CERAMIC	C1608 JB 1E 104K-T	T
C249	4030006900	S.CERAMIC	C1608 JB 1H 103K-T	T
C250	4030006860	S.CERAMIC	C1608 JB 1H 102K-T	T
C252	4550000510	S.TANTALUM	TEESVA 1V 473M8L	T
C254	4550002980	S.TANTALUM	TEESVA 1C 225M8L	T
C255	4030006900	S.CERAMIC	C1608 JB 1H 103K-T	T
C257	4610001590	S.TRIMMER	TZC3R100A110R00	T
C258	4030007020	S.CERAMIC	C1608 CH 1H 120J-T	T
C259	4030007040	S.CERAMIC	C1608 CH 1H 180J-T	T
C271	4510004630	S.ELECTROLYTIC	ECEV1CA100SR	T
C272	4030011600	S.CERAMIC	C1608 JB 1E 104K-T	T
C273	4510004630	S.ELECTROLYTIC	ECEV1CA100SR	T
C274	4030011600	S.CERAMIC	C1608 JB 1E 104K-T	T
C275	4030006860	S.CERAMIC	C1608 JB 1H 102K-T	T
C276	4510004630	S.ELECTROLYTIC	ECEV1CA100SR	T
C277	4030006850	S.CERAMIC	C1608 JB 1H 471K-T	T
C278	4030006860	S.CERAMIC	C1608 JB 1H 102K-T	T
C279	4510004630	S.ELECTROLYTIC	ECEV1CA100SR	T
C280	4030006850	S.CERAMIC	C1608 JB 1H 471K-T	T
C291	4030006850	S.CERAMIC	C1608 JB 1H 471K-T	T
C292	4030006850	S.CERAMIC	C1608 JB 1H 471K-T	T
C294	4030006860	S.CERAMIC	C1608 JB 1H 102K-T	T
C295	4030007090	S.CERAMIC	C1608 CH 1H 470J-T	T
C296	4030006850	S.CERAMIC	C1608 JB 1H 471K-T	T
C297	4030006850	S.CERAMIC	C1608 JB 1H 471K-T	T
C298	4030006860	S.CERAMIC	C1608 JB 1H 102K-T	T
C299	4030007090	S.CERAMIC	C1608 CH 1H 470J-T	T
C300	4030007090	S.CERAMIC	C1608 CH 1H 470J-T	T
C301	4030006850	S.CERAMIC	C1608 JB 1H 471K-T	T
C302	4030006850	S.CERAMIC	C1608 JB 1H 471K-T	T
C303	4030006860	S.CERAMIC	C1608 JB 1H 102K-T	T
C304	4030006860	S.CERAMIC	C1608 JB 1H 102K-T	T
C305	4030006860	S.CERAMIC	C1608 JB 1H 102K-T	T
C306	4030007090	S.CERAMIC	C1608 CH 1H 470J-T	T

[MAIN UNIT]

REF NO.	ORDER NO.	DESCRIPTION		M.
J1	6510021720	S.CONNECTOR	30FLT-SM1-TB	T
J2	6510023810	CONNECTOR	B5B-PH-K-S	T
W1	8900012400	CABLE	OPC-1264	T
W2	7120000470	JUMPER	ERDS2T0	T
EP1	0910056573	PCB	B 6015C	

M.=Mounted side (T: Mounted on the Top side, B: Mounted on the Bottom side)

S.=Surface mount

6-2 HM-141
[MAIN UNIT]

REF NO.	ORDER NO.	DESCRIPTION		M.
R1	7010007590	RESISTOR	RD1/4S 123JTA <FG>	T
R2	7010007600	RESISTOR	RD1/4 682JTA <FG>	T
R3	7010007610	RESISTOR	RD1/4 153JTA <FG>	T
R4	7010007620	RESISTOR	RD1/4 333JTA <FG>	T
C1	4030018660	S.CERAMIC	C1608 JB 1H 223K-T <FG>	B
C2	4030018670	S.CERAMIC	C1608 CH 1H 471J <FG>	T
MC1	7700002640	MICROPHONE	KUC3523-040245 <FG>	T
S1	2260002780	SWITCH	SKHHLPA010 <FG>	B
S2	2260002790	SWITCH	SKHHAMA010 <FG>	T
S3	2260002790	SWITCH	SKHHAMA010 <FG>	T
S4	2260002790	SWITCH	SKHHAMA010 <FG>	T
W1	9027150010	WIRE	71/98/010/X98/X98 <FG>	B
W2	9027150010	WIRE	71/98/010/X98/X98 <FG>	B
W3	9027150020	WIRE	24/00/020/W01/W01 <FG>	T
W4	9027150030	WIRE	24/04/020/W01/W01 <FG>	T
EP1	0910056860	PCB	B 6067	

M.=Mounted side (T: Mounted on the Top side, B: Mounted on the Bottom side)

S.=Surface mount

SECTION 7 MECHANICAL PARTS AND DISASSEMBLY

[CHASSIS PARTS]

REF. NO.	ORDER NO.	DESCRIPTION	QTY.
J1	6510004880	Connector MR-DSE-01	1
W1	8900012330	Cable OPC-1258	1
MP2	8010019300	2685 Chassis	1
MP3	8930061050	2685 R-Bush plate	1
MP4	8510015570	2685 Case [Black]	1
	8510015680	2685 Case [White]	1
	8510015690	2685 Case [Gray]	1
MP5	8930060440	2685 R-PACKING	1
MP6	8930060450	2685 F-PACKING [Black],[White]	1
	8930061190	2685 F-PACKING (A) [Gray]	1
MP7	8930034300	1542 ANT SEAL	1
MP8	8930052440	2345 B-IC CLIP	1
MP10	8510015560	2685 MODULE cover	1
MP11	8930055070	2438 SHEET	1
MP12	8810008660	Screw PT B0 M3×8 NI-ZU (BT)	6
MP13	8810008200	Screw PT B0 M2.6×6 NI-ZU (BT)	2
MP14	8810002950	Screw BiH M3×6 SUS	2
MP15	8810004540	Screw BiH M3×8 SUS	4
MP16	8810004700	Screw PH A0 3×16 SUS	4
MP17	8930061410	2685 EARTH SPRING	1
MP18	8930049040	insulation plate (FQ)	1

[MAIN UNIT]

REF. NO.	ORDER NO.	DESCRIPTION	QTY.
IC4	1150002170	S-AV35 (I)	1
W1	8900012400	Cable OPC-1264	1
W2	7120000470	Jumper ERDS2T0	1
MP1	6910015690	2685 Shield case	1
MP2	8930005320	Spacer	2
MP3	8510016170	2685 Shield plate	1

[FRONT UNIT]

REF. NO.	ORDER NO.	DESCRIPTION	QTY.
MC1	0800007150	Microphone HM-141B [Black]	1
	0800007160	Microphone HM-141W [White]	1
	0800007320	Microphone HM-141G [Gray]	1
SP1	2510001240	Speaker 045P0803	1
W3	8900012410	Cable OPC-1263	1
MP1	8210019830	2685 Front Panel [Black]	1
	8210020070	2685 Front Panel (A) [White]	1
	8210020360	2685 Front Panel (C) [Gray]	1
MP2	8930060430	2685 Key Board	1
MP3	8310059500	2685 Window plate	1
MP4	8610011370	Knob N-312 [Black]	2
	8610011630	Knob N-312 (A) [White]	2
	8610011640	Knob N-312 (B) [Gray]	2
MP5	8930014280	SP net	1
MP6	8810008200	Screw PH B0 M2.6×6 NI-ZU (BT)	4
MP7	8930052010	2345 Shaft	1
MP8	8930060480	2685 Spring	1
MP9	8110007970	2685 D-cover	1
MP10	8930060470	2685 Shaft angle	1
MP11	8930060490	2685 F-Bush plate	1
MP12	8930052280	O ring (AC)	2

[LOGIC BOARD]

REF. NO.	ORDER NO.	DESCRIPTION	QTY.
DS1	5030002590	LCD IS08251E00V0	1
EP2	8930061040	LCD contact SRCN-2685-SP-N-W	1
MP1	8210019840	2685 Reflector	1
MP2	8930060510	2685 LCD holder	1
MP3	8930061420	2685 LCD filter	1

[SQL BOARD]

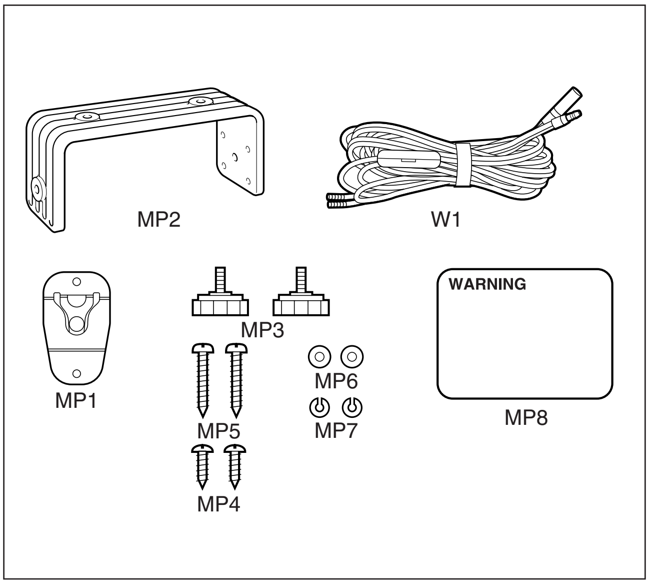
REF. NO.	ORDER NO.	DESCRIPTION	QTY.
R1	7210003150	TP96N97-15SK-10KB-2685	1

[VR UNIT]

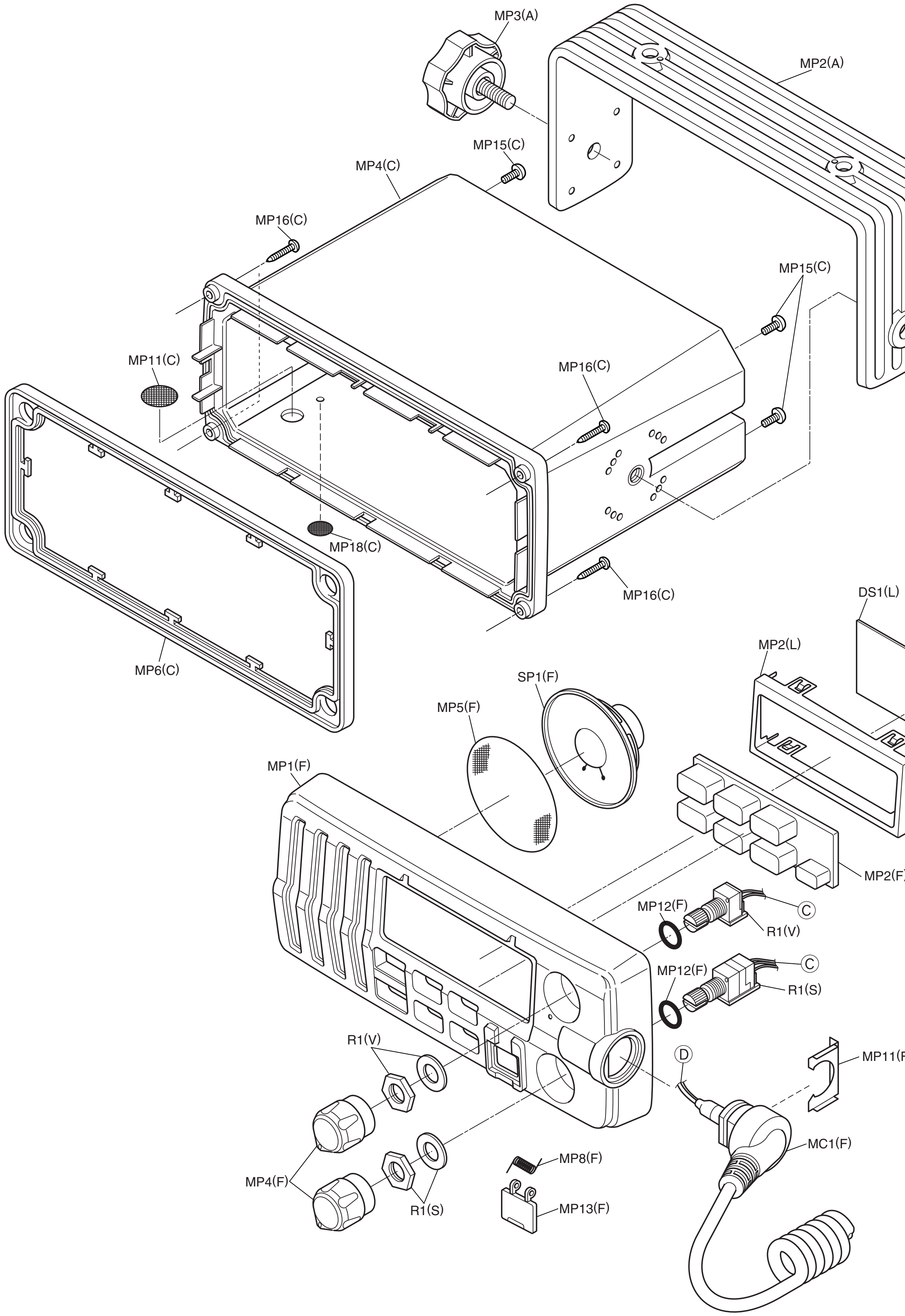
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R1	7210003140	TP96N97-15SK-10KA-2685	1

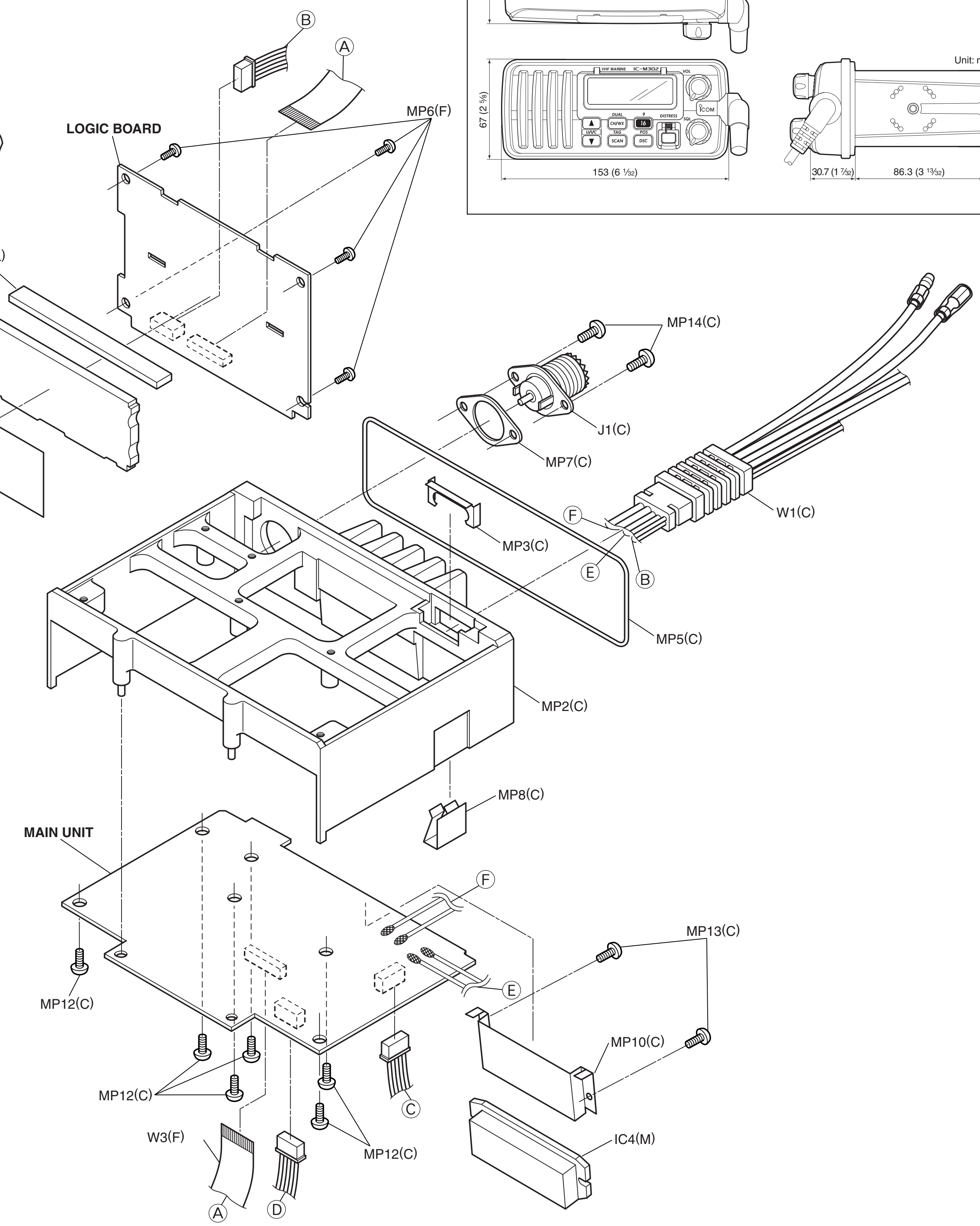
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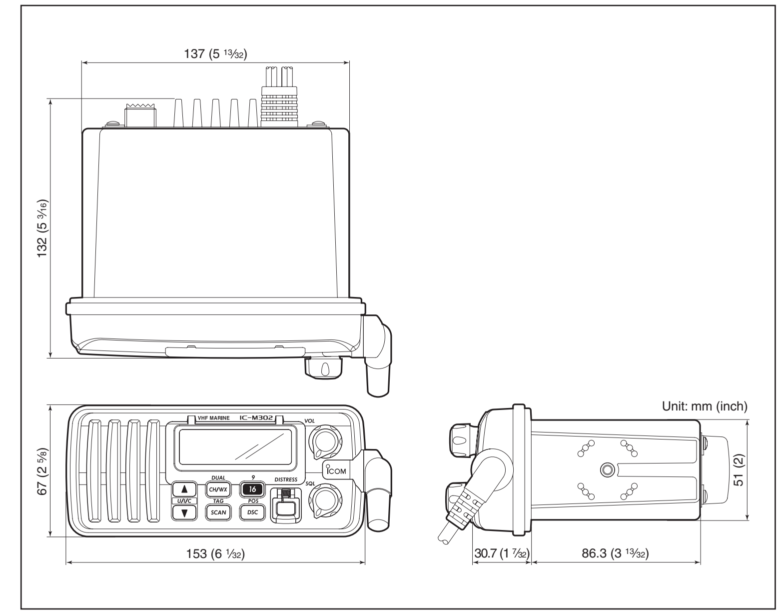
REF. NO.	ORDER NO.	DESCRIPTION	QTY.
W1	8900009040	Cable OPC-891	1
MP1	8950005110	2289 MIC hanger	1
MP2	8010017250	2040 Mobile bracket (A) [Black]	1
	8010019400	2040 Mobile bracket (B) [White]	1
	8010017250	2040 Mobile bracket [Gray]	1
MP3	8610010561	2040 Knob bolt-1 [Black]	2
	8610010591	2040 Knob bolt (A)-1 [White]	2
	8820001271	2040 Knob bolt (C)-1 [Gray]	2
MP4	8810004700	Screw PH A0 M3×16 SUS	2
MP5	8810001490	Screw PH A0 M5×20 SUS	2
MP6	8850000180	Flat washer M5 SUS	2
MP7	8850000500	Spring washer M5 SUS	2
MP8	8310050900	2438 warning sticker	1



Screw abbreviations
A0, B0, BT: Self-tapping
PH: Pan head
SUS: Stainless
NI-ZU: Nickel-zinc
BiH: Bind head
NI: Nickel







UNIT abbreviations (C): CHASSIS PARTS, (L): LOGIC BOARD
(M): MAIN UNIT, (F): FRONT UNIT
(S): SQL BOARD, (V): VR BOARD
(A): ACCESSORIES

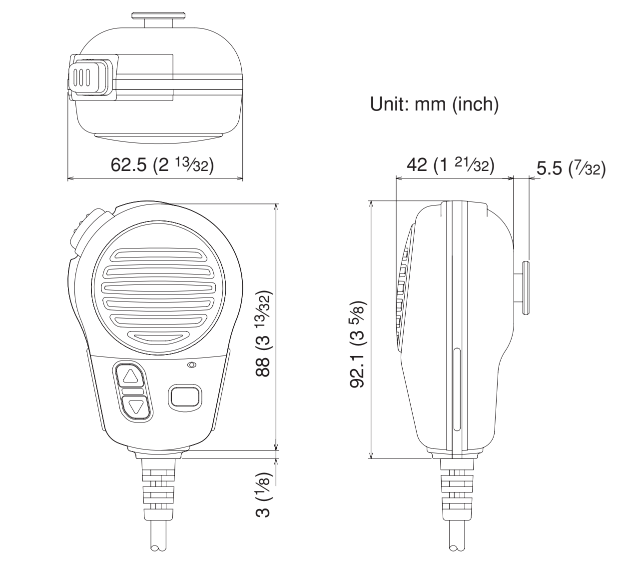
[CHASSIS PARTS]

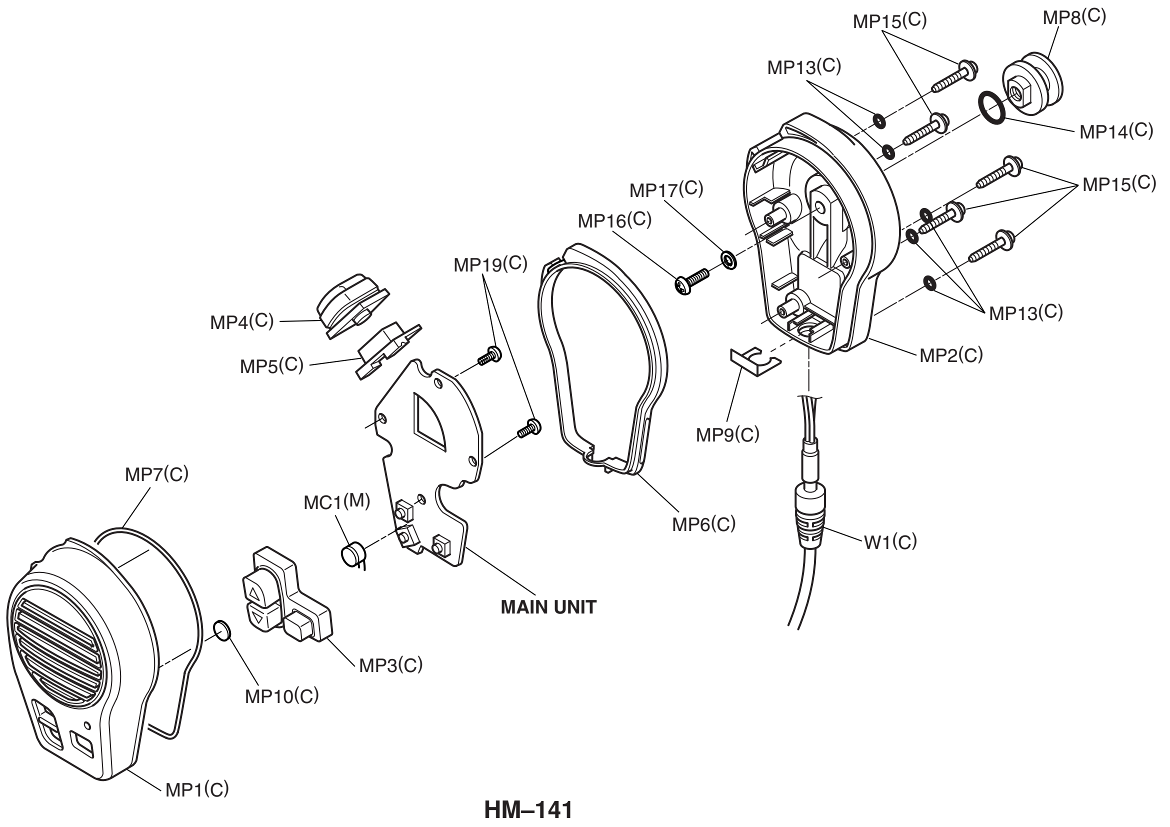
REF. NO.	ORDER NO.	DESCRIPTION		QTY.
W1	8900012211	Cable OPC-1249A	[Black]	1
	8900012221	Cable OPC-1250A	[White]	1
	8900012501	Cable OPC-1285A	[Gray]	1
MP1	8210020110	2715 front panel	[Black]	1
	8210020130	2715 front panel (A)	[White]	1
	8210020370	2715 front panel (B)	[Gray]	1
MP2	8210020120	2715 rear panel	[Black]	1
	8210020610	2715 rear panel (A)	[White]	1
	8210020380	2715 rear panel (B)	[Gray]	1
MP3	8930060910	2715 key	[Black],[White]	1
	8930061150	2715 key (A)	[Gray]	1
MP4	8930060920	2715 PTT rubber	[Black],[White]	1
	8930061160	2715 PTT rubber (A)	[Gray]	1
MP5	8930061970	2715 A-PTT holder		1
MP6	8930060940	2715 rubber	[Black],[White]	1
	8930061810	2715 rubber (A)	[Gray]	1
MP7	8930060930	2715 main seal		1
MP8	8610011600	2715 hanger knob		1
MP9	8930060950	2715 bush plate		1
MP10	9830060990	2715 MIC sheet		1
MP13	8930060960	O-ring (AY)		5
MP14	8930060970	O-ring (AZ)		1
MP15	8820001260	2715 screw 2.6x18 SUS		5
MP16	8810010230	screw BiH M4x8 ZK		1
MP17	8850002000	Spring washer M4 SUS		1
MP19	8810010240	Screw PH B0 2x6 NI		2

Screw abbreviations PH, B0,: Self-tapping
BiH: Bind head
NI: Nickel
ZK: Black
SUS: Stainles

[MAIN UNIT]

REF. NO.	ORDER NO.	DESCRIPTION	QTY.
MC1	7700002640	Microphone KUC3523-040245	1

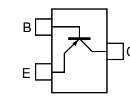
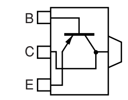
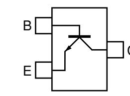
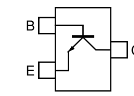
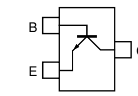
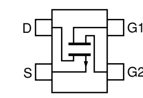
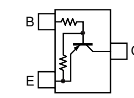
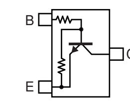
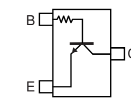
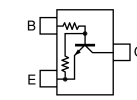
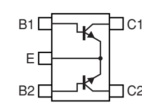




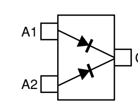
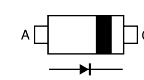
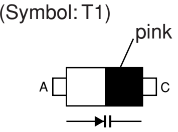
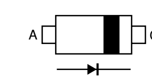
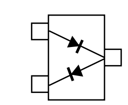
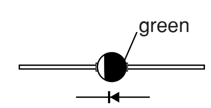
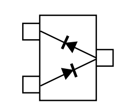
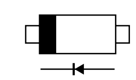
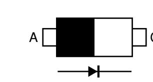
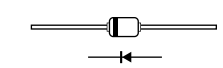
HM–141
UNIT abbreviations (C): CHASSIS PARTS, (M): MAIN UNIT

SECTION 8 SEMI-CONDUCTOR INFORMATION

• TRANSISTOR AND FET'S

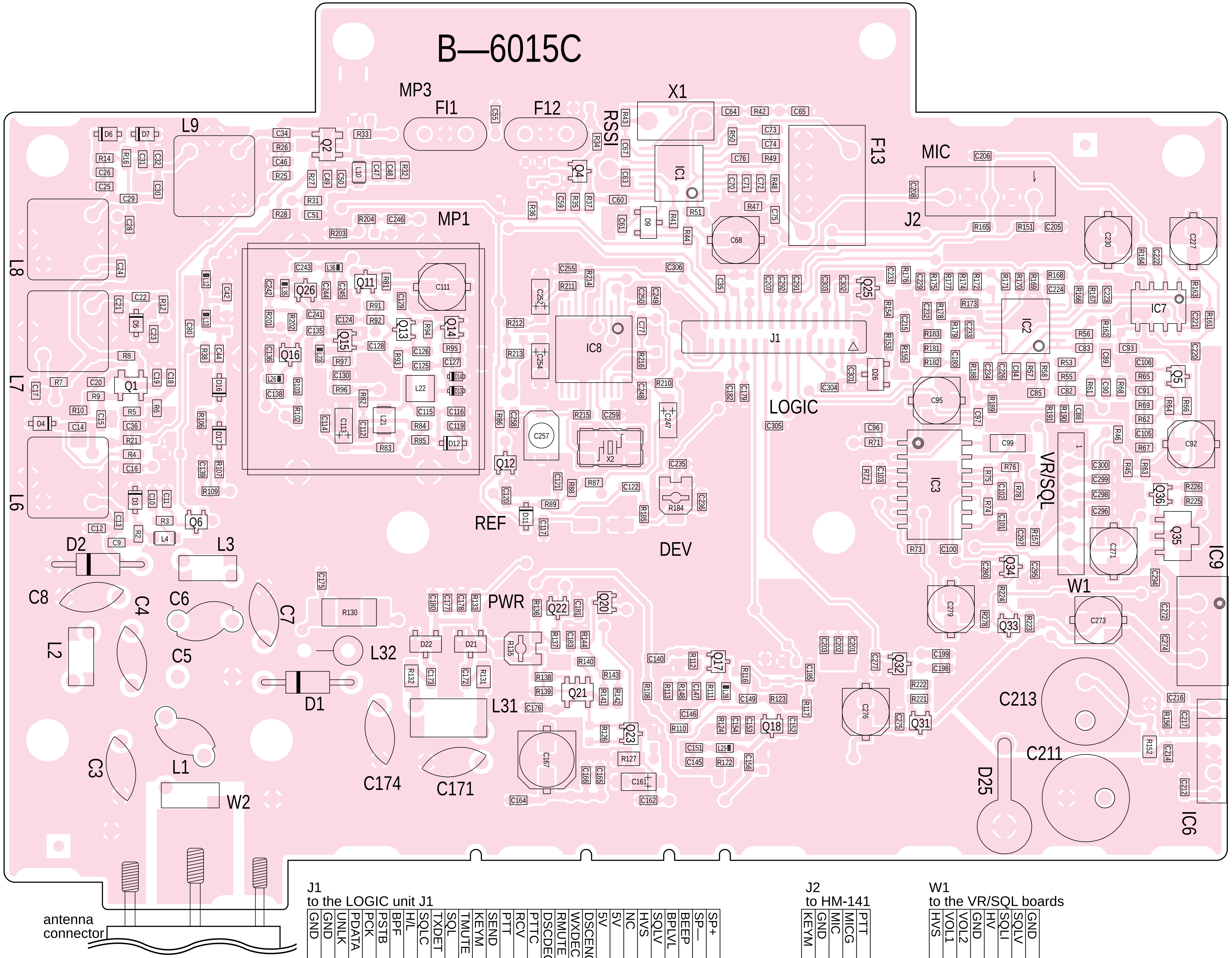
2SA1577 Q (Symbol: HP)  	**2SB1132 R** (Symbol: BARB)  	**2SC4116 BL** (Symbol: LL)  	**2SC4215 O** (Symbol: QO)  	**2SC4226 R25** (Symbol: R25) 
3SK131 L (Symbol: V12)  	**DTA144EU** (Symbol: 16)  	**DTC114EU** (Symbol: 14)  	**DTC114 TU** (Symbol: 04)  	**DTC144EU** (Symbol: 26) 
FMW1 (Symbol: W1)  				

• DIODES

1SS321 (Symbol: F9)  	**1SS355** (Symbol: A)  	**1SV214** (Symbol: T1)  	**1SV307** (Symbol: TX)  	**DA204 K** (Symbol: K) 
DSA3A1  	**HSM88ASR** (Symbol: C3) 	**HVC350B** (Symbol: BO) 	**MA77** (Symbol: 4B)  	**XB15A308** (Symbol: T8) 

9-1 MAIN UNIT

• **TOP VIEW**



J1 to the LOGIC unit J1

30																													1
GND	GND	UNLK	PDATA	PCK	PSTB	BPF	H/L	SQLC	TXDET	SQL	TMUTE	KEYM	SEND	PTT	RCV	PTTC	DSCDEC	RMUTE	WXDEC	DSCENC	5V	5V	NC	HVS	SQLV	BPLVL	BEEP	SP–	SP+

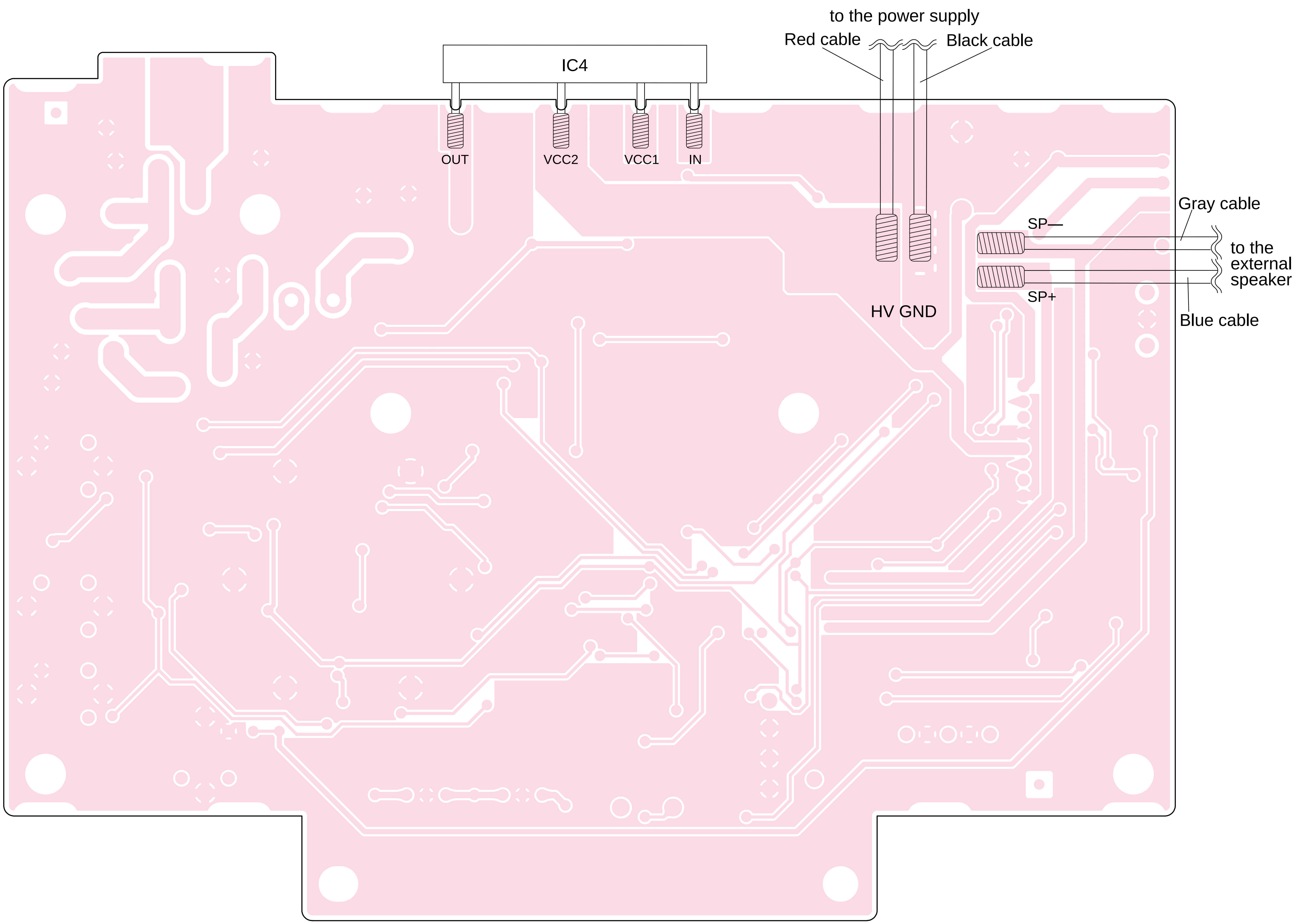
J2 to HM-141

5				1
KEYM	GND	MIC	MICG	PTT

W1 to the VR/SQL boards

8							1
HVS	VOL1	VOL2	GND	HV	SQLI	SQLV	GND

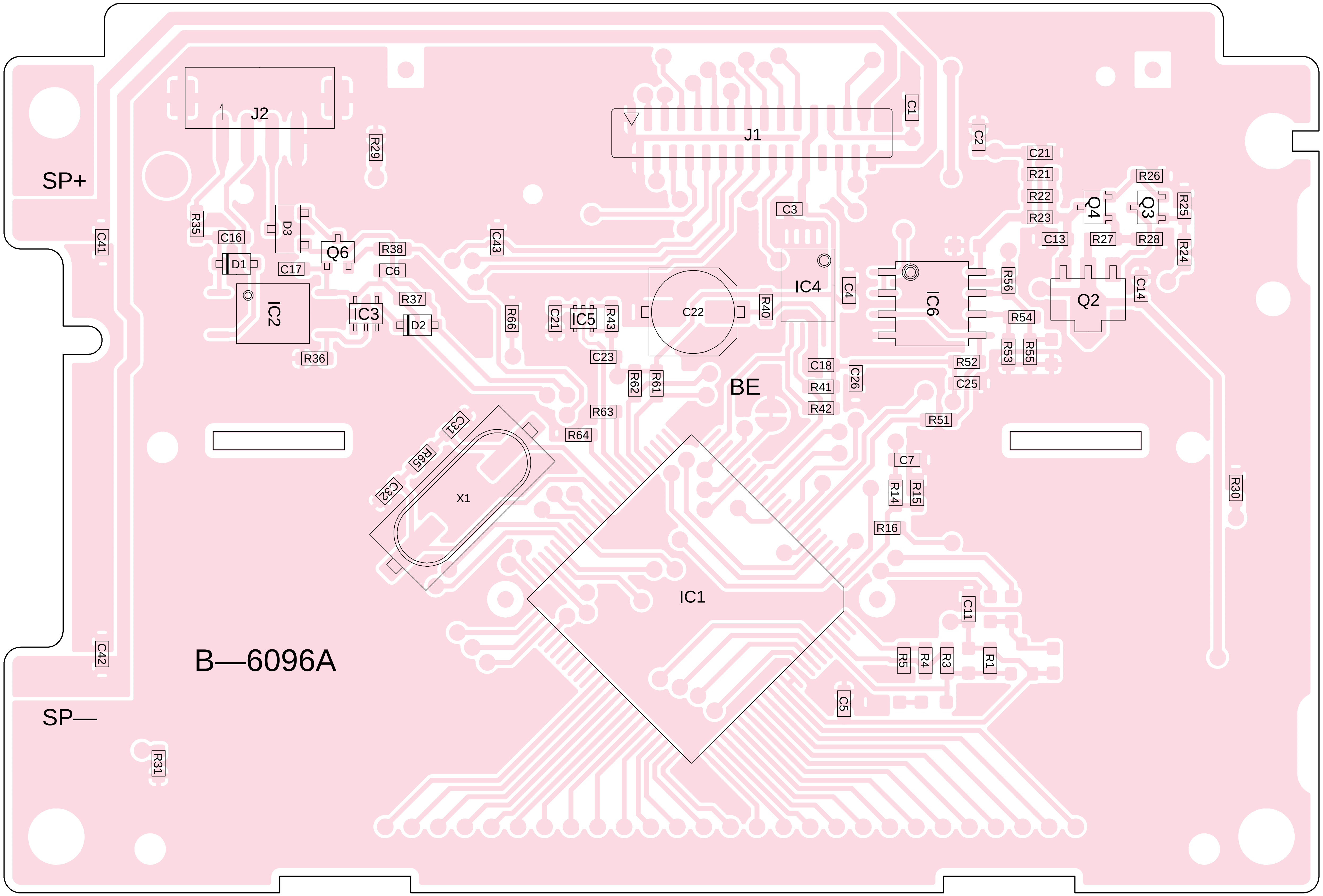
• **BOTTOM VIEW**



IC4
OUT
VCC2
VCC1
IN
to the power supply
Red cable
Black cable
HV GND
Gray cable
SP—
SP+
to the external speaker
Blue cable

9-2 LOGIC UNIT

• **TOP VIEW**



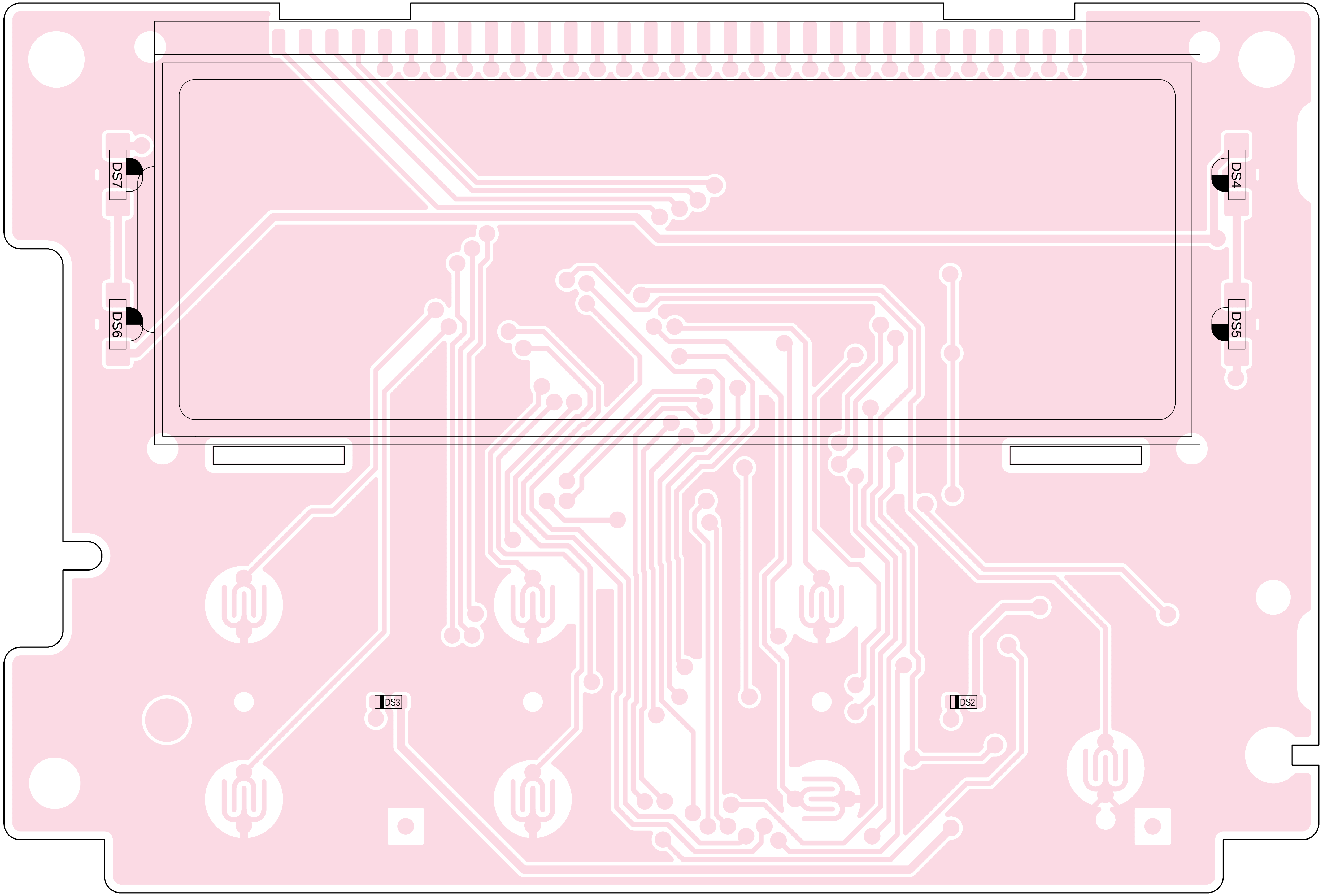
J2

4			1
GND	ICF3	NMEA—	NMEA+

J1
to the MAIN unit J1

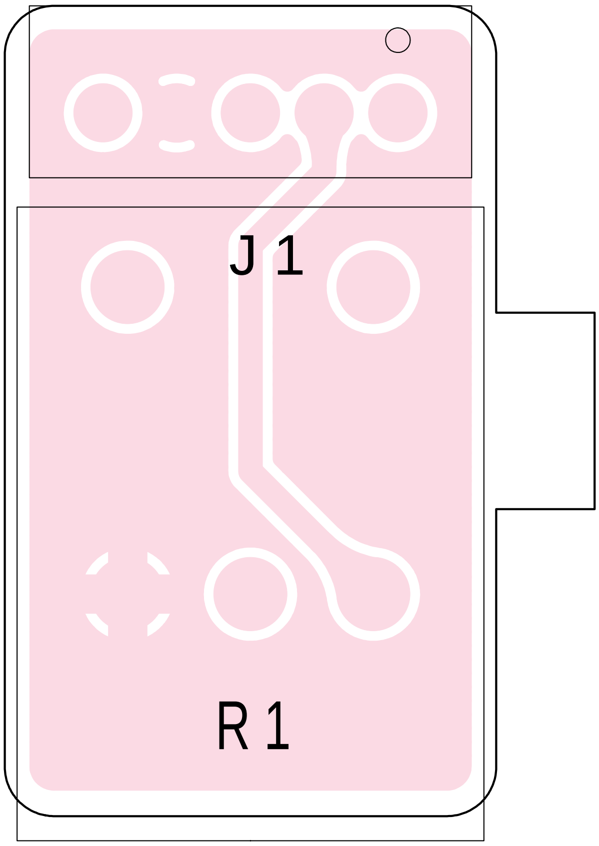
30																													1
GND	GND	UNLK	PDATA	PCK	PSTB	BPF	H/L	SQLC	TXDET	SQL	TMUTE	KEYM	SEND	PTT	RCV	PTTC	DSCDEC	RMUTE	WXDEC	DSCENC	5V	5V	NC	HVS	SQLV	BPLVL	BEEP	SP—	SP+

• **BOTTOM VIEW**



9-3 VR BOARD

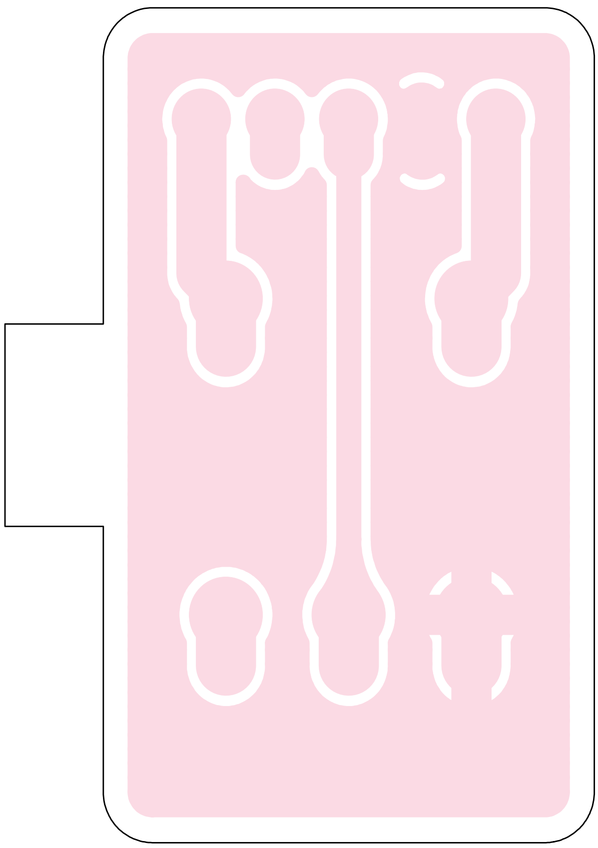
- **TOP VIEW**



J1
to the MAIN unit W1

Pin	Signal
1	HVS
	VOL1
	VOL2
	GND
5	HV

- **BOTTOM VIEW**

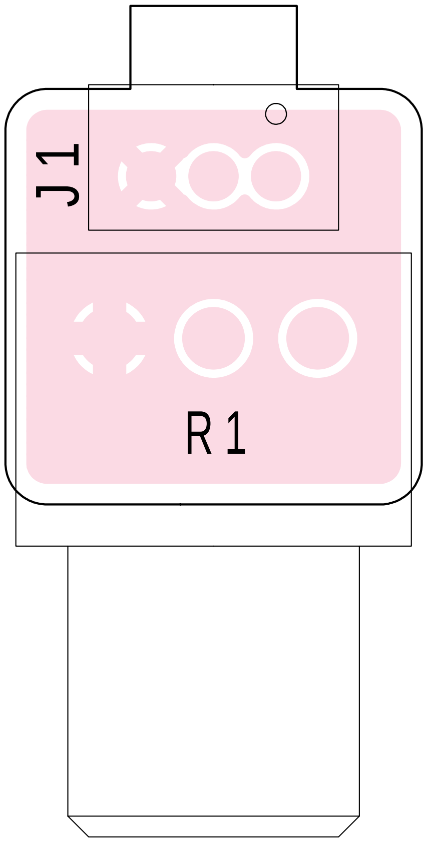


9-4 SQL BOARD

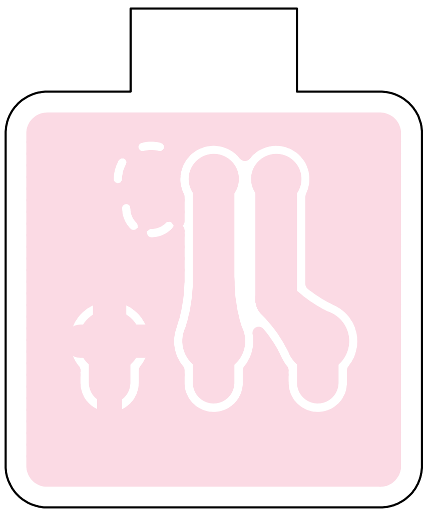
- **TOP VIEW**

J1
to the MAIN unit W1

1	SQLI
	SQLV
3	GND

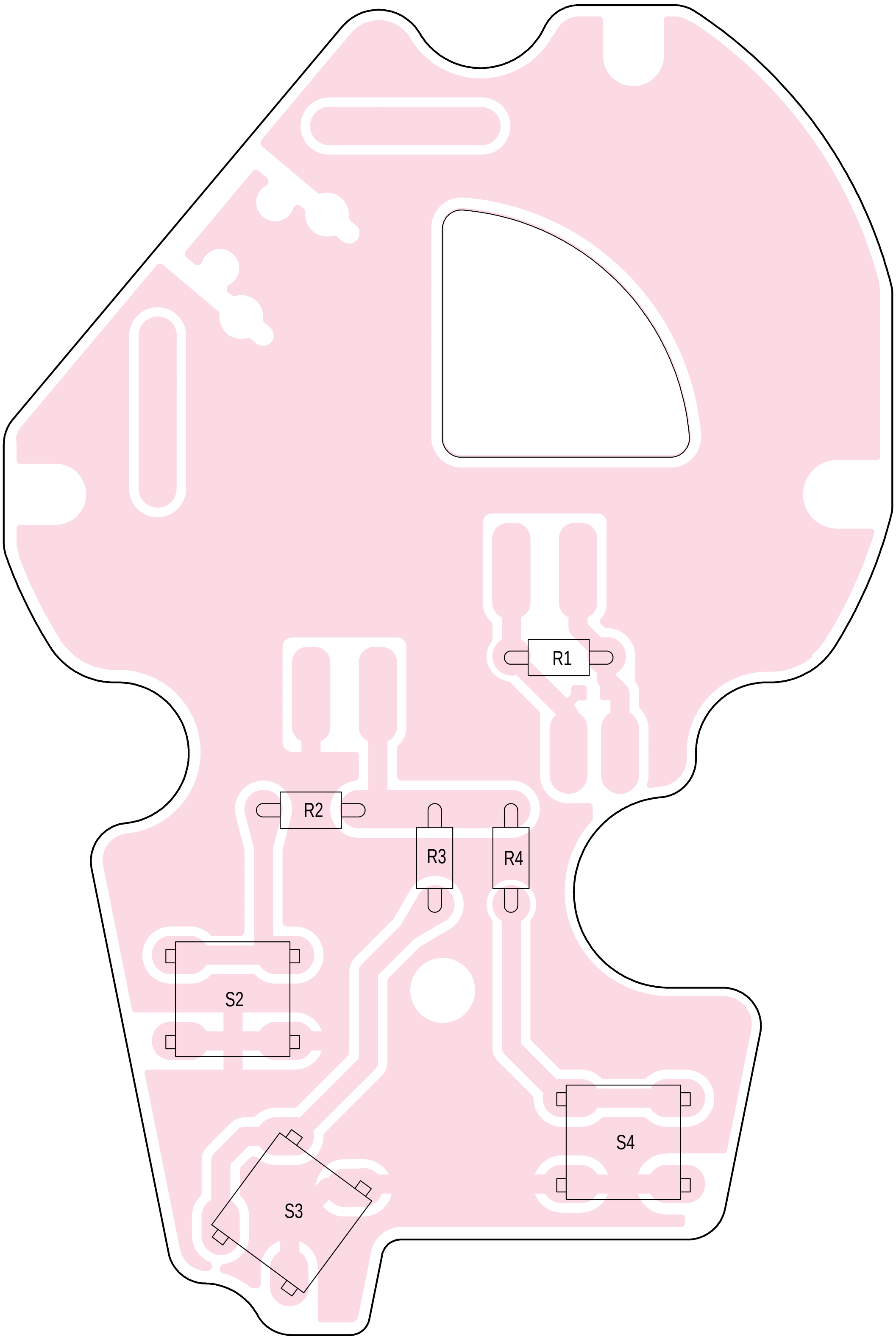


- **BOTTOM VIEW**

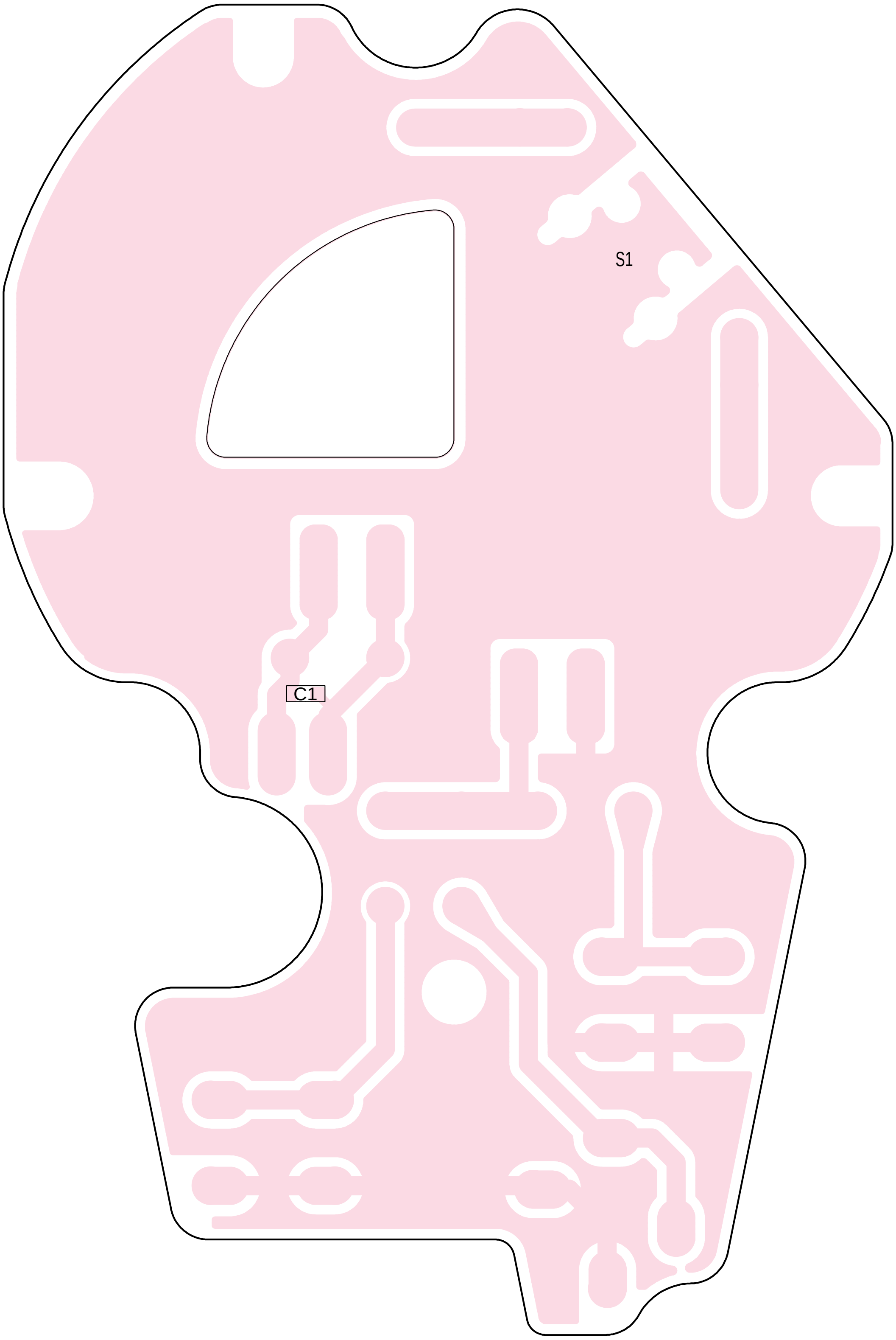


9-5 HM-141

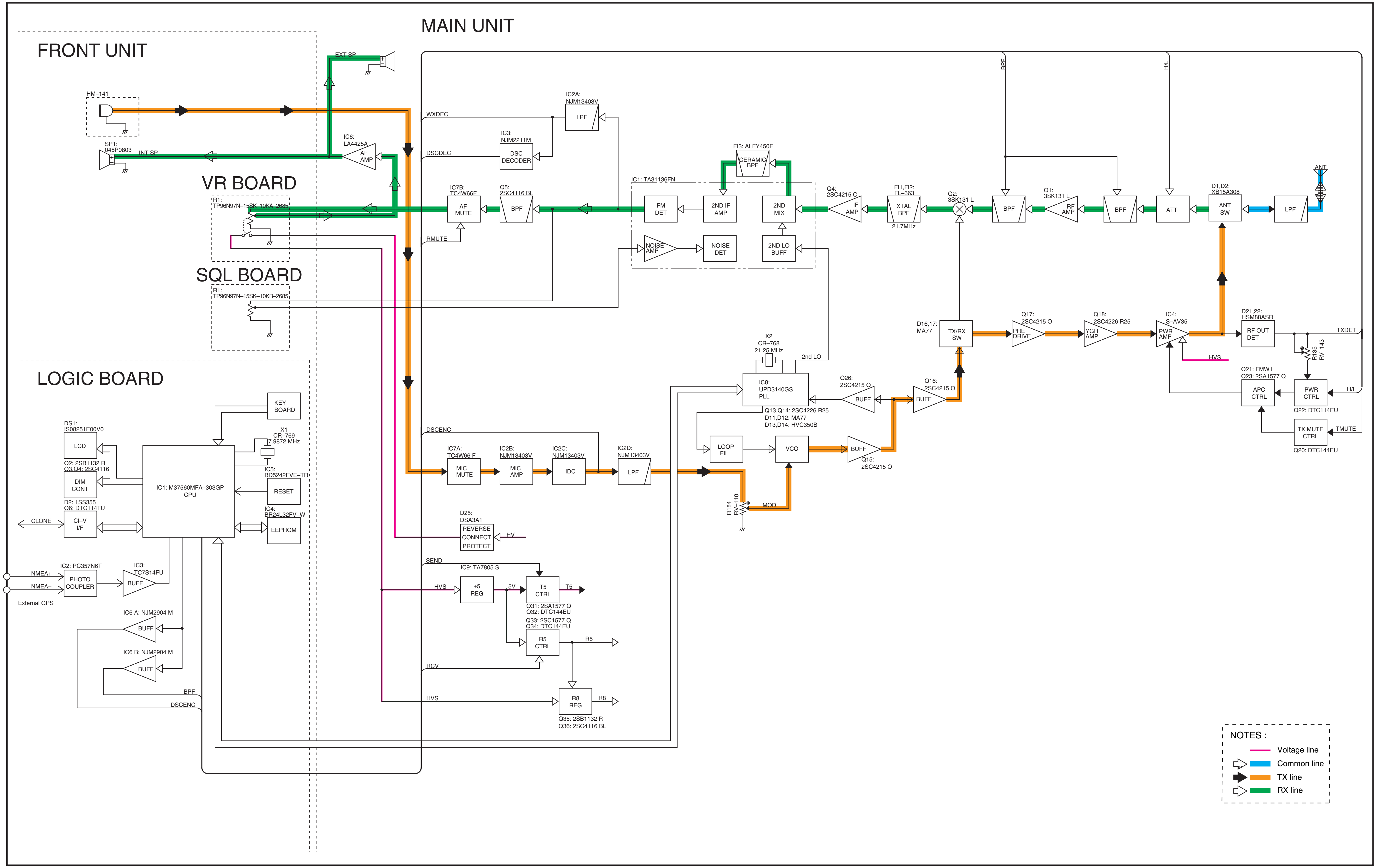
- **TOP VIEW**



- **BOTTOM VIEW**

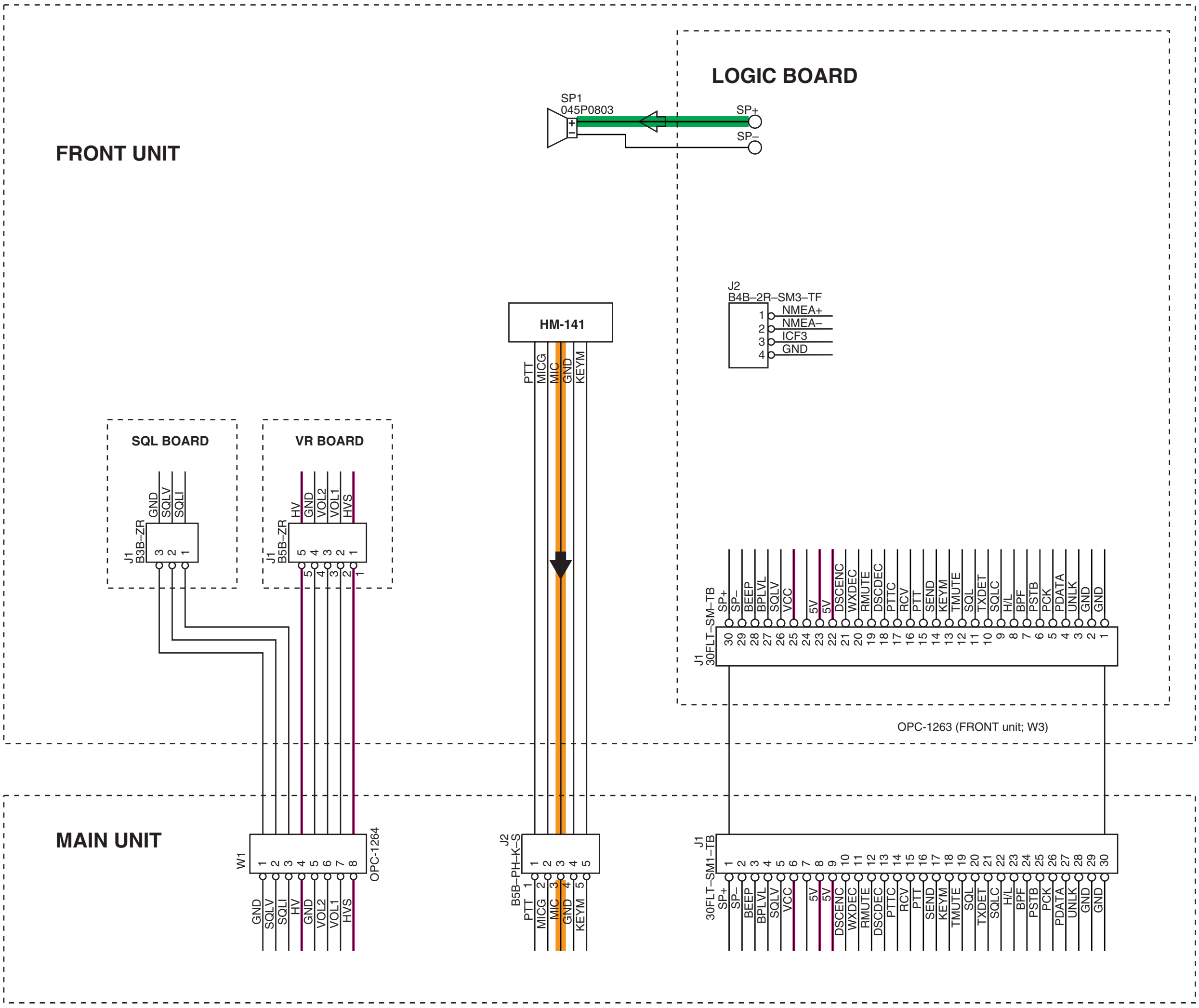


SECTION 10 BLOCK DIAGRAM

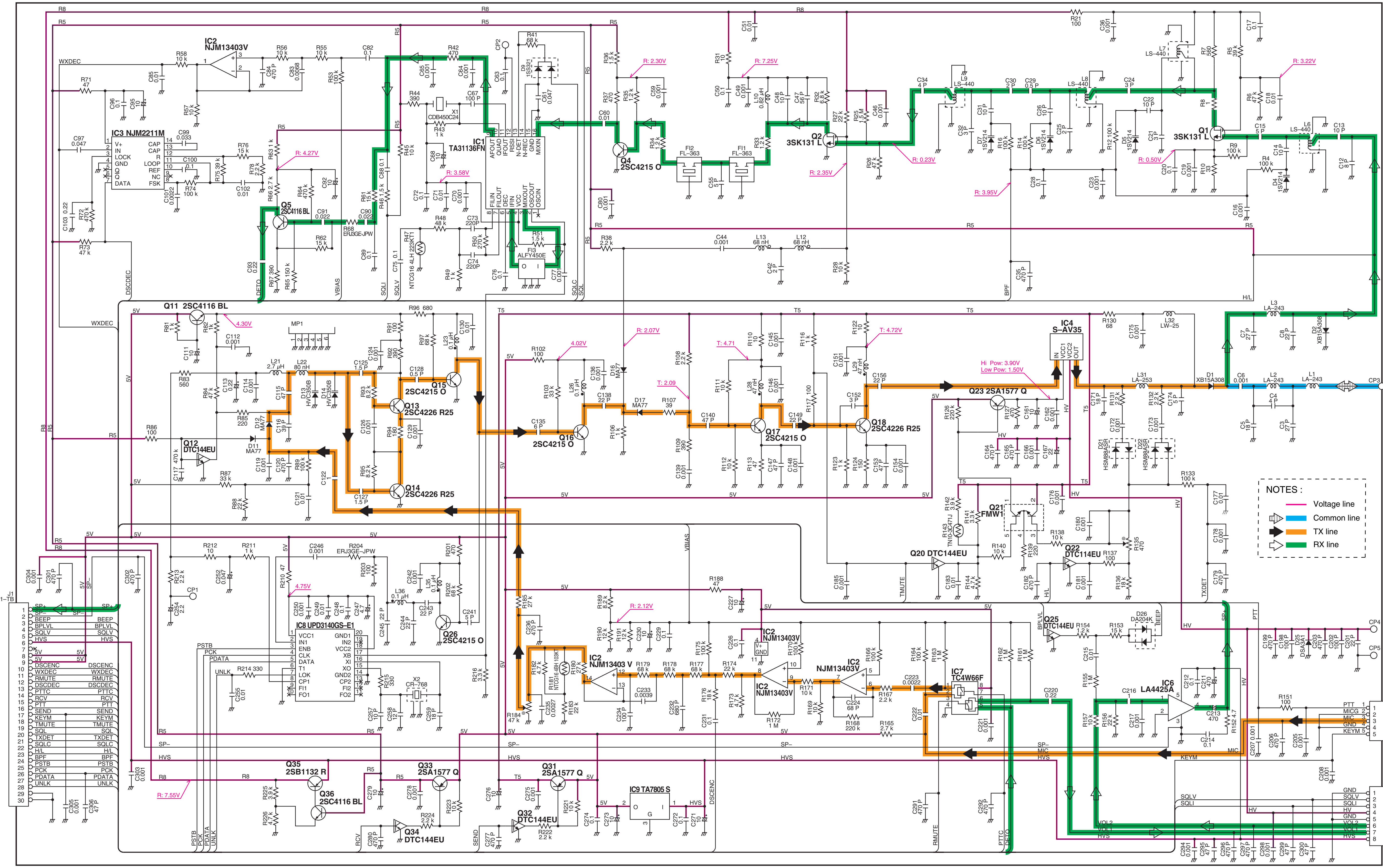


SECTION 11 VOLTAGE DIAGRAM

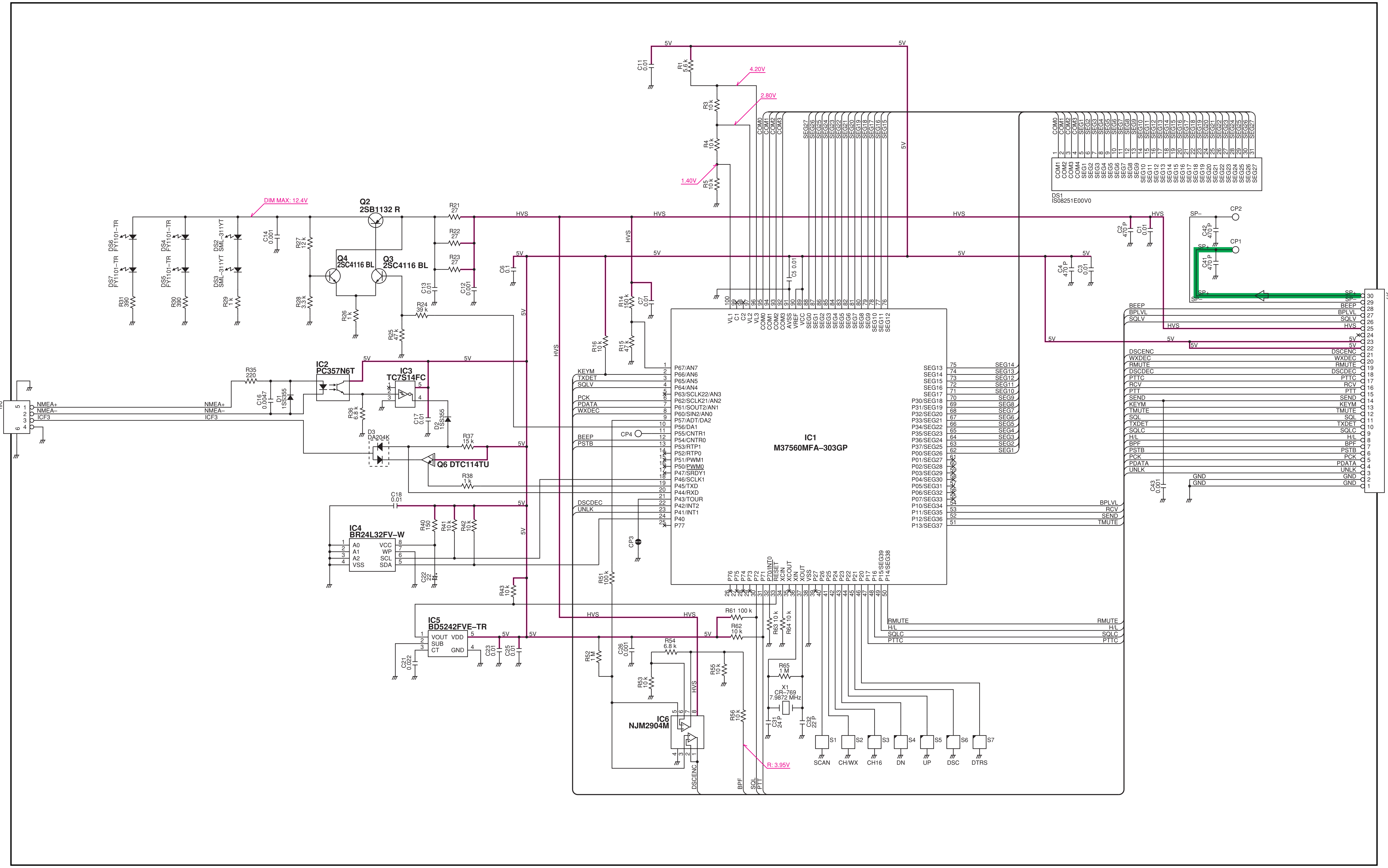
11-1 GENERAL



11-2 MAIN UNIT

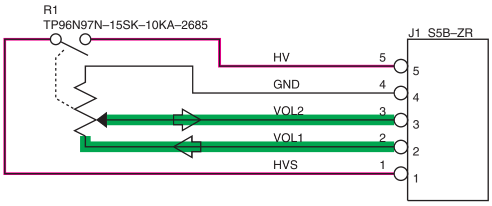


11-3 LOGIC UNIT

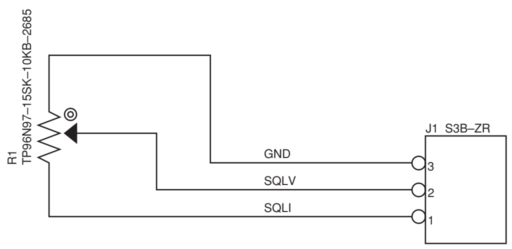


11-4 VR/SQL BOARD

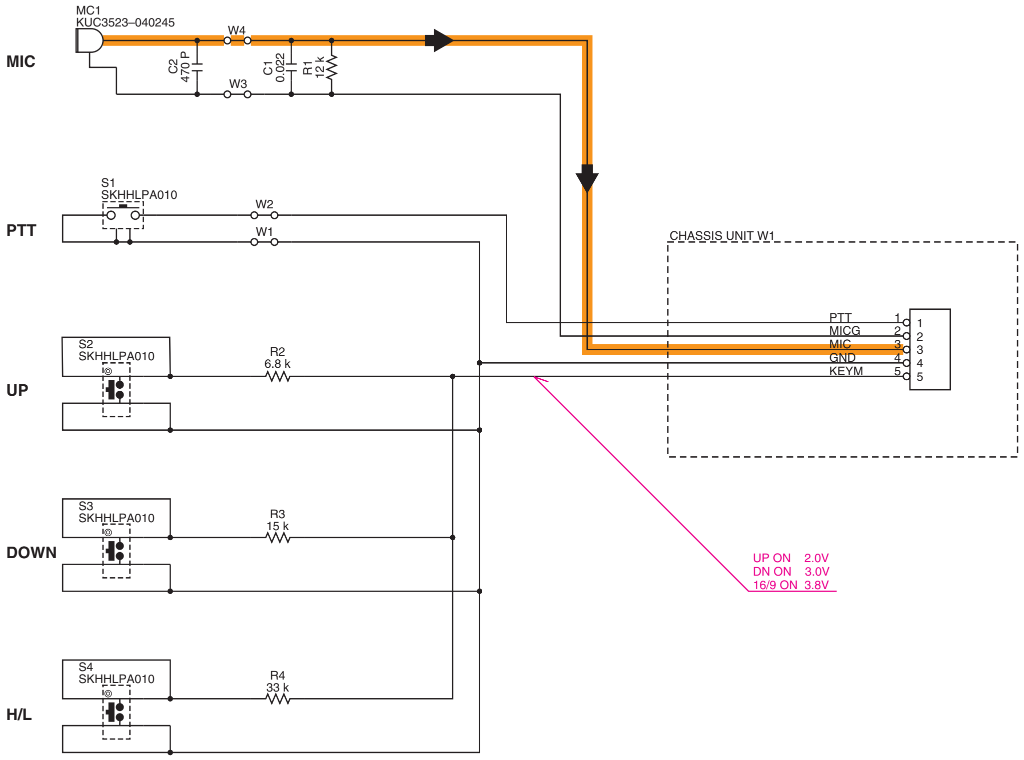
VR BOARD



SQL BOARD



11-5 HM–141


MIC
MC1
KUC3523–040245
W4
C2
470 P
W3
C1
0.022
R1
12 k
PTT
S1
SKHHLPA010
W2
W1
CHASSIS UNIT W1
PTT
MICG
MIC
GND
KEYM
UP
S2
SKHHLPA010
R2
6.8 k
DOWN
S3
SKHHLPA010
R3
15 k
H/L
S4
SKHHLPA010
R4
33 k
UP ON 2.0V
DN ON 3.0V
16/9 ON 3.8V

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